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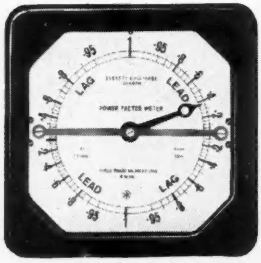

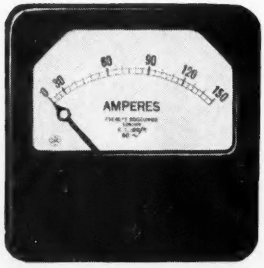

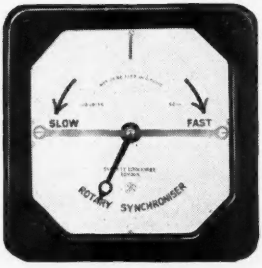

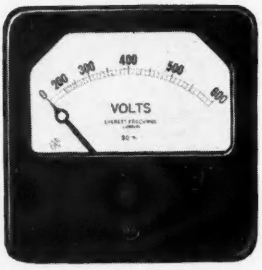

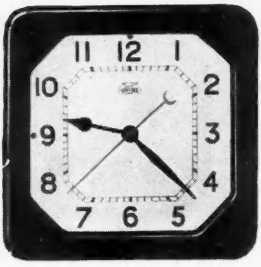

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ELECTRICAL REVIEW

Vol CXLIX No. 3849 31ST AUGUST, 1951

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872

Modern Generation

CO-ORDINATION OF TECHNICAL FEATURES

ALTHOUGH the main features of generating plant tend to become standardized, primarily with a view to expediting manufacture, such standardization is being carried out at a high level and allows reasonable opportunities for taking advantage of new scientific and engineering developments as they mature. A general indication of these developments will be found in an article on page 426, which is based on particulars recently given by Mr. V. A. Pask (chief engineer, B.E.A.) in connection with the current programme of power station construction.

Plant Characteristics

The design and manufacture of numerous component parts by specialists in each case form only one aspect. No less important is the need for a correct choice of plant characteristics to give the best overall results in circumstances that vary greatly from site to site and for the co-ordination of these characteristics to make a power station regardable as a single machine for the production of electricity.

Steam turbine, feed-heat boilers and inlet temperature of circulating water to condensers must have the closest thermodynamic relationship and be associated with auxiliary services that will enable theoretical results to be achieved. Any lack of balance is likely to result in savings in one direction being lost in another throughout the twenty-five years or so of the station's useful life.

Costs and Efficiency

As a corollary of these considerations Mr. F. W. Lawton (controller, West Midlands Division), who has been responsible for the design of a number of large stations, has drawn attention to the essential requirement that the conception of the project as a whole should be brought to one focal point in the initial planning stage. Capital costs and thermal efficiency have to be related to operating costs at a predetermined average load factor and also to reliability over a number of years; plant layout, often dictated by local conditions, materially affects both, especially as regards the number of men employed in operation and speed of maintenance.

Even though the thermal efficiency of a station is largely settled permanently by steam conditions, there remains a sizeable margin between actual and maximum possible efficiencies which can be controlled by skilful operation. This margin comes under two headings. The first refers to the loading of

generating units in accordance with their economical performance as part of the grid system—now usually an ideal only in view of plant shortage; the other is largely under the control of the power station operation engineers. In an article which he contributed to our issue of 8th June Mr. W. S. Burge (formerly controller, East Midlands Division) suggested a method of assessing operational merit, which seemed to us to furnish a promising aid in bringing to light weak spots.

New designs almost inevitably introduce risks to availability in dealing with which experience may be no sure guide. "Teething troubles" must be accepted as part of the price of progress. Combustion difficulties are far less nowadays, thanks to the work of the Boiler Availability Committee. One unfortunate result of the present insufficiency of generating plant is the small scope it gives for experimental work. That is likely to hamper progress far more than the degree of standardization that has hitherto been achieved.

POWER FROM OLD SHIPS

One of many measures for mitigating load shedding now under consideration by the North Regional Board for Industry is the fitting of generators to engines or turbines in obsolete ships. Any help from this source is likely to be small, however, even if mooring near grid points were always permissible and adequate space were available for accommodating the electrical plant. P. & O. or Orient liners of 24,000 tons could produce less than 20 MW from their propelling turbines and 1·7 MW from existing 220 V d.c. sets. Vessels of the size of the "Queens" would be required in order to make a really substantial contribution. The electrically propelled "Normandie" of comparable tonnage was equipped with four 33·4 MW alternators.

FLOATING POWER STATIONS

Especially constructed craft have been used to a small extent for emergency service in the United States, and a few years ago Mr. C. T. Allan suggested their adoption in Great Britain. A proposal now mooted in the daily Press is that fifty floating power stations should be built at a cost of £1 million each, which is said to be only half the cost of a similar land station. It is claimed that this plan would close the 2,000 MW gap between demand and plant capacity, so each vessel would presumably contain 40 MW of plant at £25 instead of over £50 per kW. As the costs entering into the comparison would be only some 25 per cent of the total, it is not clear from published figures how this large reduction comes about.

CAPITAL CUTS

Apart from plant shortage and a possible insufficiency of coal the electricity supply industry is being dogged by a third shadow—capital expenditure cuts. The North Western Electricity Board is reported to have expressed doubts as to its ability to meet demands for new supplies—even to industry—and it has had to postpone some of its rural schemes. The Board is hopeful of fulfilling its housing-estate commitments up to the end of the year but the Manchester Housing Committee is unhappy at the prospect and at the possibility of having to examine alternatives to electricity. It says that it is doubtful whether gas undertakings could cope with an "all-gas" housing estate and it prophesies a slowing down of housing if the Electricity Board is not allowed to spend more. Other Boards will find themselves in a similar predicament; indeed, the Southern Board has already had to issue widespread warnings that capital restrictions are forcing it to decline new connections.

HEATING LOAD

A problem which confronts the Irish E.S.B. as well as the English authorities, is that of space heating. It is said that in Ireland the unrestricted heating demand is tending to exceed the total industrial load. Steps are being taken to limit the demand and to transfer the heating load to off-peak hours. The Board's revised rates include a charge of 1·7d/kWh for heating but there are "restricted hours" charges of 0·4d/kWh between 11 p.m. and 8 a.m. and 1·2d/kWh between 8 a.m. and 11 p.m. ("subject to peak interruptions"). For storage water heating the rates are 0·6d/kWh between 11 p.m. and 8 a.m. and 0·7d between 8 a.m. and 11 p.m., again "subject to peak interruptions." The Board's 1950–51 report (summarized on page 451) makes it clear that increases in these charges are not far off.

The Fannich Project

Central Supervisory Control of Scattered Plant

THE general scope of this hydro-electric project in the County of Ross and Cromarty was broadly outlined as No. 3 constructional scheme, authorized in 1945, of the North of Scotland Hydro-Electric Board. It is the first stage of water power development within the River Conon basin[1] which forms a catchment area of 350 sq miles with an average rainfall of 75in yearly.

An output of up to 442 million kWh annually is expected eventually to be generated by the installation of 107 MW of plant in six stations as follows: 24 MW at Grudie Bridge, 24 MW at Glascarnoch, 2 MW at Achanalt, 24 MW at Luichart and 15 MW at Torr Achilty, with a further 18 MW that will form part of the Orrin project.

Grudie Bridge, in Ross-shire, is the first major base-load station in the northern part of the Board's territory. It is served by Loch Fannich, which is 6½ miles long with a water area of 3½ sq miles, in a catchment area of 55·2 sq miles where the average rainfall is 79in yearly. There is no impounding dam at present. The outlet from the bottom of the loch[2] through a hillside tunnel enables its level to be drawn down by 50ft, representing storage equivalent to 62 per cent of the yearly output of the station.

The building of a dam 1,500ft long, specified in No. 16 constructional scheme, to raise the loch level by 20ft, will enlarge its storage capacity sufficiently to augment the output by nearly 4 million kWh yearly and, additionally, permit Fannich water to be utilized by the Luichart and Torr Achilty stations. Completion of the dam will provide storage equivalent to 83 per cent of the expected 83 million kWh annual output, at a mean net 495ft head, of the Grudie Bridge plant, which was put into full operation in December, 1950.

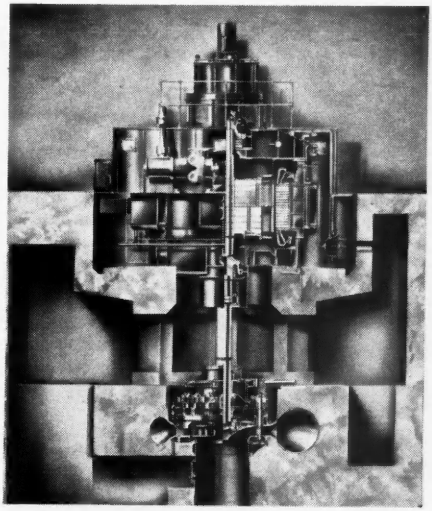


Fig. 1.—Model elevation of turbo-generator arrangement

The two Harland-Morgan Smith hydraulic turbines are of the single runner Francis type, designed to operate at up to 554ft maximum gross head of water. Each turbine is guaranteed to produce 17,000 b.h.p. at 458ft net, equivalent to 12,000 kW, although the two alternators have regularly generated 26,000 kW. One machine has easily delivered 14,700 kW, equivalent to 20,400 b.h.p., and representing a 20 per cent overload.

Each vertical shaft is of 14½in diameter, off which there are neither gear nor belt drives. This feature of mechanical design will be appreciated by the maintenance staff. The differential pressure across a section of the spiral casing from the inner to the outer radius of the turbine is utilized for measuring the flow of water through the machine. Translation into quantity is by a mercury column varying the resistance of an electrical

[1] See maps, *Electrical Review*, 22nd September, 1950, p. 484, and 17th August, 1951, p. 339.

[2] See cross-sectional diagram, *Electrical Review*, 22nd September, 1950, p. 483.

circuit in which is an indicating voltmeter calibrated directly in cusecs. Integrators and recorders are also built into the instrument cubicle. The turbines are almost completely of welded construction. Each is direct coupled to a Bruce Peebles vertical generator (see Table I) totally enclosed for ventilation by recirculating air, which enters at both ends of the frame and is propelled by fans fitted at both ends of the rotor through ducts to the back of the stator, thence through six Serck water coolers disposed round the stator frame before again entering the housing.

TABLE I—GENERATOR SPECIFICATION

Max. cont. rating	13,333 kVA
Active load at 0·9 p.f. ..	12,000 kW
Terminal voltage	11 kV
Frequency	50 c/s
Phases	3
Speed	500 r.p.m.
Runaway speed	875 r.p.m.
Flywheel effect	490,000 lb-ft² (WR^2)
Voltage tolerance	plus 10% and minus 15%
Inherent reg. at unity p.f. ..	13%
Inherent reg. at 0·9 p.f. ..	23%
Efficiency at rated output and 0·9 p.f.	97·25%
Line charging capacity ..	6,667 kVA zero leading p.f.
Total weight	94 tons

Hand-operated louvres provide warm machine air for heating the station in cold weather, the make-up air then being drawn in through Serck filters. Each generator is mounted on a plinth (Fig. 1) supported by vertical struts; the height above floor level is 12ft 9½in (Figs. 2, 4 and 5).

Each stator frame was fabricated from steel plate, built in two sections to facilitate transport. Its diamond-wound coils are laid in open slots and insulated to Class B standard. It has two circuits in parallel per phase and is star connected. To minimize eddy current losses, the conductor laminations are transposed throughout the winding. Individual conductors are covered with impregnated glass tape and separated from each other with mica. Slot portions of each coil are moulded with micafolium ironed on hot and the ends of the wrap, which are tapered off, are sealed with mica tape. The top and bottom coils in the slot are spaced apart with leatheroid separators. Embedded temperature detectors are provided for use with the dial type thermometer.

Each rotor body was built up from nine rolled steel plates machined all over, shrunk on to the shaft and secured by transverse bolts. Dovetailed grooves were machined in the assembly into which the poles, built up of dovetailed laminations clamped between rounded steel end-plates by fitted bolts, were pressed and keyed to avoid undue stressing of the material. The rotor coils consist of copper strip wound on edge, insulated between turns with asbestos and mounted on flanged brass spools with Bakelite washers at top and bottom. The coils are insulated from the spools by glass cloth and Micanite, reinforced with leatheroid, and are mutually braced. A winding on the periphery of the poles damps out any oscillations which may occur during disturbances on the line. The underside of the rotor is fitted with six renewable machine-finished Meehanite cast iron brake segments secured by spring-loaded bolts to provide for thermal expansion without buckling.

The thrust bearing, designed for a load of 85 tons, is of the Michell segmental type. Both thrust and upper guide bearings are insulated to prevent shaft currents. A second guide bearing below the rotor is carried on two transverse beams, which can be removed to allow the housing to be lowered by a tackle for inspection and to give access to the brakes and jacking gear.

All bearings are flow lubricated from an overhead distributing box fed from a 400 gall reservoir at 8 lb/sq in. They are fitted with mercury-in-steel thermometers connected to dials on the turbine panel; each dial carries two adjustable contacts, one to initiate an alarm and the other to shut down the machine before the danger point has been reached. Oil-flow indicators also have alarm contacts.

The braking gear, carried on the bottom bearing bracket, consists of four Tangye cylindrical hydraulic jacks fitted with Ferodo pads. In operation compressed air at 8 lb/sq in is admitted to the oil reservoir and jacking oil is pumped in by hand at 1,000 lb/sq in, the weight then being transferred to the six screw jacks.

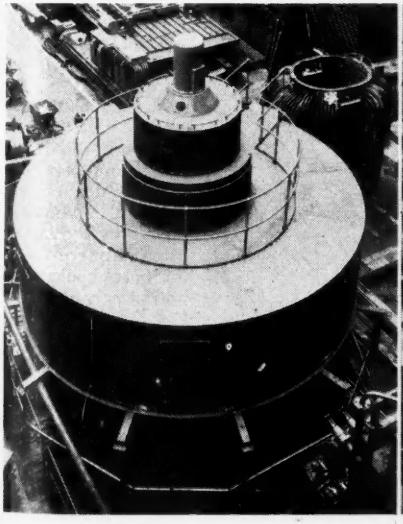
Each generator has a main and a pilot exciter, the latter providing the field excitation for the main exciter. They are mounted one above the other on top of the thrust bearing bracket and directly coupled to the main generator shaft. A Woodward permanent-magnet alternator mounted at the extreme top of the assembly energizes the turbine-governor motor, which runs in synchronism with the p.-m. alternator so that any change in the speed of the main generator is transmitted to the governor.

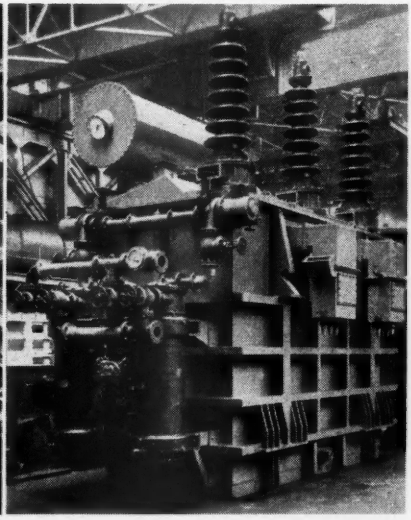
Self-resetting, snap-action, mercury switches are incorporated in the p.-m. alternator; the overspeed switch operates at 30 per cent above normal speed and the underspeed switch is electrically interlocked with the brakes, so that in an emergency shutdown they cannot be applied until the speed of the generating set reaches 95 per cent of normal speed. Under normal conditions the brakes come into action when the speed falls to 50 per cent of normal.

An electric motor-driven speeder gear enables the speed of the generating set to be varied, manually or by remote control, from plus 5 per cent to minus 15 per cent of normal for synchronizing and distribution of load between the machines. There is also a speed drop adjustment which can be set at any value between zero and minus 5 per cent of normal speed to suit parallel running conditions.

Such auxiliary equipment as circulating water pumps for the generator, lubrication and transformer cooling systems, governor and lubricating oil pumps, compressor sets, etc., is driven by 415 V motors which are energized from 50 kVA transformers, the primaries of which are connected to the 11 kV terminals of the generators and their secondaries to unit auxiliary switchboards. Normally, the starters are latched-in so that the auxiliaries run up to speed with the generating set they serve. Other electrically-driven auxiliaries obtain power from a common services switchboard which can also be energized from either of the two 250 kVA earthing transformers associated with the main 20 MVA transformers, or from a 3 MVA, 33/0·415/11 kV linking transformer serving a local 33 kV line from Beauly. Selection of one of these transformers is made automatically in a predetermined sequence at a selector panel which also provides for the switching of one to the other in the event of the failure of any one transformer. The unit auxiliary boards and common services boards can be interconnected with one or other of the generators, or can be energized independently from the main transformers, which are directly connected to the 132 kV line from Beauly substation, for testing the auxiliaries when the turbines are shut down. The main electric circuit diagram (Fig. 8) shows that d.c. at 240 V is available from a battery for standby auxiliaries and control circuits and at 50 V for alarms and telephones. Battery charging rectifiers receive their input from the 415 V common services board.

Fig. 2.—Vertical 13,333 kVA alternator on test in makers' works. Fig. 3 (right).— Water-cooled 20 MVA 11/132 kV transformer partially erected in makers' works

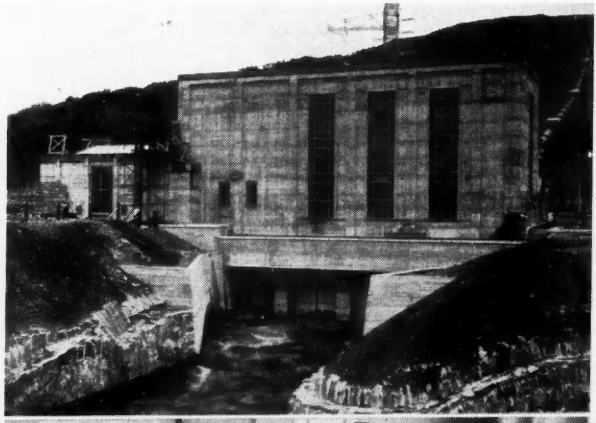


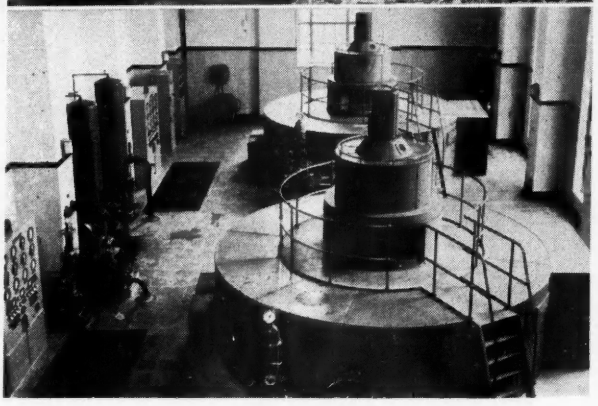


The two generators are connected through circuit breakers to the 11 kV busbars which are coupled to two 20 MVA, 11/132 kV delta/star Bruce Peebles outdoor oil-immersed water-cooled transformers (Figs. 3 and 6) mounted on a concrete raft at the back of the station, immediately above the bifurcated pipeline.

The transformers are of the conventional core type, with vertical legs provided with transverse oil ducts to assist cooling of the iron. The innermost coil, wound on an insulating cylinder next to the core, is a tapping winding that is interwound to ensure magnetic balance on all tapping positions, which cover a range of plus 15 per cent in eight steps and are taken to a linking chamber arranged so that on-load tap-changing switchgear can be installed when required. This winding is separated by an insulating cylinder from the second layer, consisting of part of the h.v. winding. Next there is an insulating oil duct and an insulating cylinder carrying the main l.v. winding and outside it there are two insulating cylinders, with special L-piece separators, and the main h.v. winding. The spacers assist oil circulation and raise the insulation strength between windings and from the h.v. winding to earth. The windings are formed of disc coils. Conductor insulation consists of paper tape protected on the outside with cotton lashing and, in order to meet the severe stresses to be expected under onerous impulse conditions due to lightning, the arrangement of coils and insulation both between turns and sections is graded. One limb of the h.v. winding is reversed so as to reduce the electric stress between phases. The h.v. winding has been subjected to an impulse test of 640,000 V.

The transformers are cooled with forced oil, the coolers with their electric motor-driven oil pumps being mounted on one end of the tanks. For auxiliary natural cooling a small bank of radiators is mounted on the opposite end of the tanks, to deal with no-load losses only. The cooling system is duplicated, each pump being capable of dealing with full-load requirements by forcing oil through one or other of the Serck coolers. In the latter the oil passes





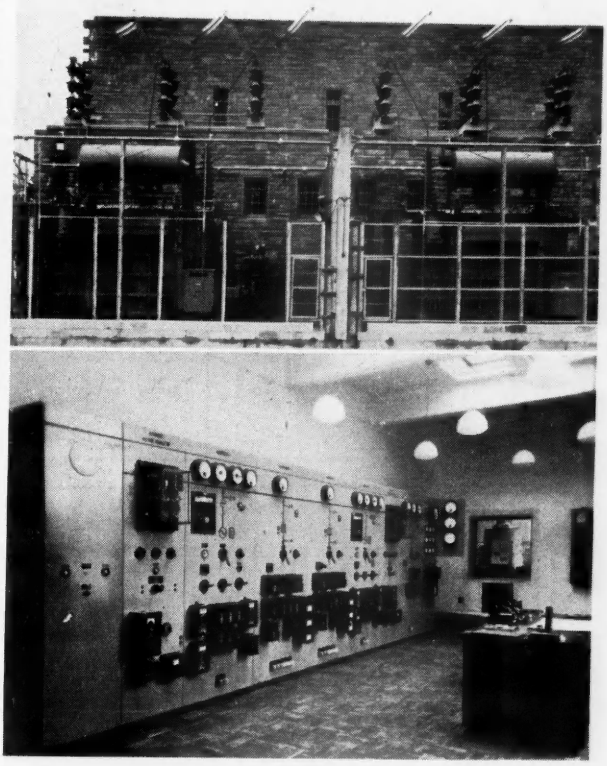
Top: **Fig. 4.—General view of Grudie Bridge water power station.** *Below:* **Fig. 5.—Two 13,333 kVA 11 kV 500 r.p.m. vertical alternators installed in this power house**

along a nest of small-bore tubes mounted in a jacket through which water is circulated to dissipate the heat from the oil; a duplex valve allows either pump or cooler to be used. Failure of a pump results in changeover to the standby set and an alarm is operated, while flow alarms fitted to both oil and water pipes incorporate auxiliary contacts which bring the transformer out of circuit in the event of a potentially dangerous condition arising. Regulators on the outlet side of the coolers ensure that the pressure of the oil is always above that of the water.

Temperature indicators designed to simulate the condition of the windings comprise a dial type thermometer with maximum and minimum contacts, and alarm contacts, the mercury bulb of which is immersed in the oil of the transformer. The bulb is situated in a resistance winding which is fed from a current transformer mounted over one of the l.v. main leads. The apparatus operates in conjunction with mercury switches and relays which give an alarm and cut out the transformer at a predetermined bulb temperature.

The main transformers are also provided with Buchholz protection and 250 kVA. 11,000/415 V earthing transformers, which also serve low voltage circuits in the station. Each transformer weighs 73 tons, or 62 tons stripped for transport.

Control of the remote stations is visualized from a supervising centre at Contin. At Grudie Bridge three types of control are at present available: (*a*) manual, by which the starting and stopping operations are carried out by the usual gear; (*b*) push-button, from centralized stations; (*c*) semi-automatic, from a single push-button which puts into operation the complete sequence of functions necessary to bring the plant to the "ready to synchronize" condition. The first two systems of control follow general hydro-station practice. The third one is a semi-automatic sequential-parallel method (Figs. 7 and 8) by which the starting impulse energizes a master contactor and simultaneously starts the standby Pelton turbine-driven governor-oil pump and d.c. motor-driven bearing-oil pumps (driven from the station battery) and opens the solenoid-operated by-pass valve. As soon as the spiral casing is



Top: **Fig. 6.—Water-cooled 20MVA 11/132kV generator transformers installed at Grudie Bridge.** *Below:* **Fig. 7.—Main control room panel in power station**

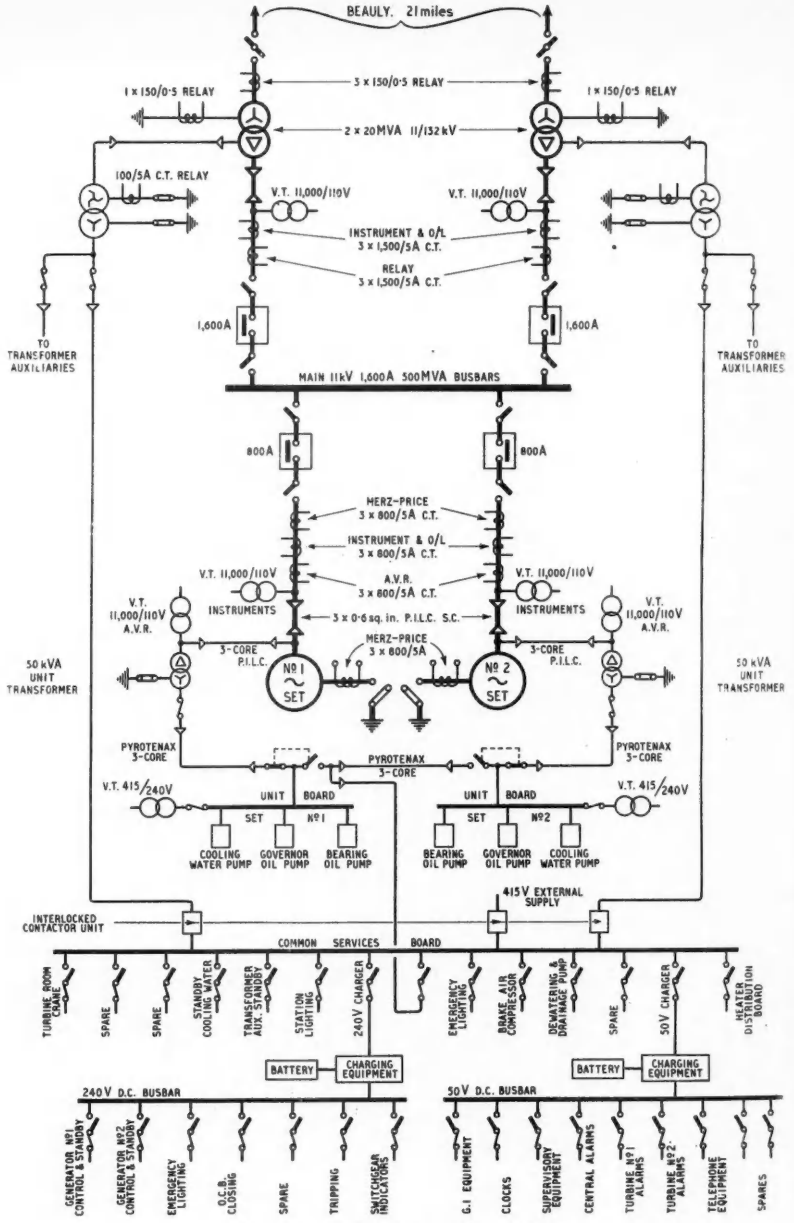


Fig. 8.—Basic circuit connection diagram

filled with water and the pressure across the main shut-off valve has equalized, the solenoid-operated main valve opens and latches-in the by-pass valve, which is de-energized and shut immediately the main valve is fully open. As soon as relays indicate that the pressure of the governor oil is correct, the turbine main valve is open, circulation of oil to bearings established, brakes are off and jacks lowered, the governor solenoid is energized to open the guide vanes and let the turbine run up to speed under control of the governor.

As the voltage in the directly connected unit transformer rises, the essential main a.c. motor-driven auxiliaries (governor-oil, bearing-oil and circulating-water pumps, the starters of which are latched-in and normally closed) run up in unison with the turbine and automatically take over the loads of the standby pumps, which then shut down. When all functions have been properly established, as indicated by relays, a signal is given that the set is ready for synchronizing. It is then operated entirely from the control room by means of switches controlling the governor-speeder motor, motor-operated generator field rheostat, automatic voltage regulator and the switching on to the network through oil circuit breakers. If for any reason the starting sequence should fail at any point, the starting-up operation would be cancelled and the nature of the defect indicated on the alarm panel by a flashing light.

The standby turbine-driven governor-oil pump already mentioned delivers oil into a bus-pipe to which the main pumps are also connected, and is automatically re-started in the event of the pressure in the bus-pipe falling below a certain value.

Upon the stop impulse being issued (the generator having been first relieved of load and the oil circuit breaker opened) the governor solenoid is de-energized, causing the turbine gates to close. The turbine valve-closing solenoid is then energized, latching-out the pilot valve and de-energizing itself. The butterfly valve is thus made to close. If the valve should for some reason fail to close, the alarm system would come into operation. When the speed has dropped to about 50 per cent a relay operates and oil is supplied to the brake shoes, which stop the set. After a time lag sufficient to ensure that the turbine has come to rest the brake shoes are released automatically. The essential auxiliaries automatically shut down with the main plant and when the bearing-oil pressure falls below a certain value the standby bearing-oil pump runs up, shutting down again after a time sufficient to ensure that the turbine has stopped.

In the event of faults arising, illuminated signals operate in conjunction with audible alarms and a flashing beacon lamp. The protective devices are classified according to their effects: (*a*) simultaneous release of oil circuit breaker and stopping of the set occurs upon development of a generator internal fault (Merz-Price protection), overcurrent and overvoltage, overspeed, low governor oil pressure, abnormal bearing temperature and (*b*) release of the oil circuit breaker controlling the transformer occurs in the event of internal faults (Buchholz protection), overload, failure of water-coolers, or failure of both oil-pump motors.

Recapitulating, the protective and supervisory equipments are provided with light indicators on the fault alarm panels to give instant indication of the protective device which has operated. The signal apparatus functions under any of the following conditions: bearing temperature high, failure of cooling water, bearing oil-flow failure, governor oil pressure low, stator air temperature high, failure to start, main inlet valves not fully open, guide vanes failed to open, main inlet valve failed to close, or overspeed.

The consulting engineers were Sir Alexander Gibb & Partners for the civil engineering, Messrs. Merz & McLellan for mechanical and electrical work and Messrs. Kennedy & Donkin for power transmission.

Balfour Beatty & Co., Ltd., were responsible for the tunnel work; Mechans, Ltd., pipeline; J. Bissett & Sons, Ltd., station buildings; Bruce Peebles & Co., Ltd., alternators and main transformers; Harland Engineering Co., Ltd., and Drysdale & Co., Ltd., water turbines and hydraulic gear; Woodward Governor Co., Ltd., turbine governors; Glenfield & Kennedy, Ltd., main inlet and relief valves; A. Reyrolle & Co., Ltd., h.v. circuit breakers and main control panels; Contactor Switchgear Co., Ltd., contactor gear and turbine control panels; Standard Telephones & Cables, Ltd., auto-control equipment, relay and alarm systems, 11 kV cables; W. T. Henley's Telegraph Works Co., Ltd., 132 kV overhead transmission lines.

VIEWS on the NEWS

By REFLECTOR

AMONG those who consider that the domestic use of electricity (except for lighting and other small applications) is a misdemeanour is Mr. R. H. S. Crossman, M.P. In the *Sunday Pictorial* he presents the old argument that 80 per cent of the heat from coal burned in a power station is wasted and also damns the open coal fire (with more justice) for its wastefulness. He advocates closed stoves or gas for heating and proposes to discourage the use of electricity by raising the price sharply after allowing cheap rates for the smaller uses. Considering Mr. Crossman's political affiliations one would not expect him to advocate a system which would confine the extensive use of electricity to the better-off. And, from the economic point of view, he should also explain how electricity can be supplied at a cheap rate for lighting, radio and vacuum cleaners only.

* * *

Although the National Trust for Scotland and the planning authorities of the area wished electrical distribution in Glencoe to be underground they have finally agreed to the erection of overhead lines by the North of Scotland Hydro-Electric Board. I have seen a number of Press references to this but not one has referred to the " Massacre of Glencoe "—an omission which I hasten to remedy.

* * *

A list of desirable improvements to domestic appliances suggested by a writer in the *Sunday Times* indicates that there are still ways in which manufacturers might exercise their ingenuity and provide still more labour-saving features. I am glad to be able to say that at least one of the writer's desires can be realized right away, namely a vacuum cleaner with a disposable paper bag. Although I do not know of a plug with a cable reel incorporated or a reel which can be built into the base of a table or standard lamp, etc., there are various devices available for taking up slack flex, including one referred to recently in the *Electrical Review* primarily for use on telephones. I think the writer must have been unlucky in the types of toaster she has encountered for many of them are fitted with crumb trays, but I quite agree that there is a demand for a low-priced coffee grinder. Surely it should not be necessary to buy a complete food mixer. Finally I am sure some manufacturer would, for a consideration, be only too pleased to provide a small lift.

* * *

Even in these enlightened days it is surprising how little is known of the most elementary features of electricity supply or of the relative consumption of electrical appliances. Wishing to use my electric razor or, to use its fashionable name, dry shaver, I inquired at a hotel where I was staying a few nights ago whether the supply was a.c. or d.c. No one appeared to know and it was not until I had consulted most of the occupants of the bar that I was able to elicit the fact that it was a.c. The manageress told me—maybe she meant it jocularly—she would add the cost to my bill and she looked a bit incredulous when I said that if she charged me a penny that would cover the cost for a year.

* * *

There was a time when " the electric light " gave enterprising hoteliers quite an advantage over their gas-bound rivals and, coupled with electric lift installations, had a great influence upon those seeking accommodation. I thought that both were now taken for granted in hotels of any standing and yet I have just seen a folder issued by a leading Bournemouth establishment in which it is proudly boasted that electric light is installed throughout, as well as lifts to every floor. So the old magic is still there.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE City and Guilds of London Institute for the Advancement of Technical Education announces the appointment of **Mr. J. W. Voelcker**, A.C.G.I., B.Sc., A.M.I.E.E., as secretary of the Institute to succeed **Mr. G. C. Stephenson**, A.C.A., who has now retired, but will continue to help and advise in the work of the Institute. Mr. Stephenson has held the position of secretary of the Institute since 1924.

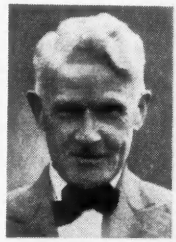
Mr. Voelcker was educated at Rugby. After serving in the 1914-18 war with the Royal Engineers, he gained a Governors' scholarship to the City and Guilds College where he studied electrical engineering in 1920-22. In the latter year he went to the United States and after post-graduate study leading to a Master's degree and some teaching experience at the Massachusetts Institute of Technology, he returned in 1925 to join the English Electric Co., Ltd., with which he remained until this present appointment. During the last war he rejoined the Royal Engineers and attained the rank of major. Mr. Voelcker is the general editor of *The Central*, the journal of old students of the City and Guilds and Finsbury Technical Colleges. He is also an hon. secretary in this country of the Massachusetts Institute of Technology and president of the M.I.T. Club of Great Britain. He represents the City and Guilds Institute on the governing bodies of three Surrey technical colleges.

Mr. S. Beckinsale, B.Sc., A.R.I.C., has been appointed general manager of the Metropolitan Electric Cable & Construction Co., Ltd. Mr. Beckinsale was the deputy manager of the Power Cables Division of British Insulated Callender's Cables, Ltd., joining the Callender Co. in 1927 as chief chemist and metallurgist after publishing the results of his researches into the failure of lead cable sheathing by cracking and its prevention. This work was carried out in the Research Department, Woolwich, where he was senior metallurgist.

Mr. S. Beckinsale

In 1939 he was appointed cable manager at Callender's Erith Works, and in that capacity was responsible for the manufacture of buoyant cables, mining cables, much of the "Pluto" pipe line and super-tension cables including the first 132 kV three-core gas pressure cable used in service in this country. Mr. Beckinsale has been author or joint author of numerous papers on metallurgical subjects, insulating oils and the bitumens used in the electrical industry.

Mr. H. Trencham, M.Inst.C.E., M.I.E.E., consulting switchgear engineer to the British Thomson-Houston Co., Ltd., Willesden, has retired after nearly thirty-six years' service with the company. Mr. Trencham's early technical training was received as a pupil with Veritys, Ltd., after which he obtained further experience with the Electric & Ordnance Accessories Co., Ltd., A. Reyrolle & Co., Ltd., and Voigt & Haeffner. He was associated with much of A. Reyrolle's early design work on metal-clad switchgear and he continued his work on this class of switchgear when he joined the B.T.H. Switchgear Division in 1925. In 1928 he was appointed consulting engineer on switchgear matters, and in this capacity he dealt not only with switchgear problems, but also gave advice on the design of cinematograph lanterns and pioneer work in connection with the electric totalizator. In 1927 he made a world tour. He was the B.T.H. representative on various technical committees in connection with switchgear practice and activities, including various sub-committees of E.R.A. and B.S.I. Serving on many A.E.I. and B.T.H. Engineering Committees, his work included representation on the Management Committee of the Switchgear Testing Co. He was joint author with Dr. K. J. R. Wilkinson of a paper on the restriking voltage indicator, for which a special I.E.E. premium was awarded in 1937. He was one of the original members of the B.T.H. Technical Papers Committee, formed in 1938.



Mr. H. Trencham

The Minister of Supply has appointed **Lt.-Gen. Sir Frederick Morgan** as Controller of Atomic Energy from 1st October in succession to **Lord Portal of Hungerford.**

Mr. E. A. T. Edwards, M.B.E., has been appointed a deputy labour relations officer of the British Electricity Authority in succession to **Mr. T. Cochrane** who retired at the end of July. Mr. Edwards received his education at the Sutton County Grammar School and Ruskin College, Oxford, and later studied international industrial relations in the International Labour Office, Geneva. For a number of years he was employed in transport undertakings until, in 1938, he became an officer of the Transport and General Workers' Union. Just before vesting day he was appointed district labour relations officer for Merseyside and North Wales, transferring a year later to B.E.A. headquarters in London as an assistant deputy labour relations officer.

The Metropolitan-Vickers Electrical Co., Ltd., announces the appointment of **Dr. C. Dannatt,** O.B.E., M.C., M.I.E.E., director and chief electrical engineer, as director of research and education in place of **Sir Arthur P. M. Fleming,** C.B.E., D.Eng., who retains his seat on the board. Dr. Dannatt is also appointed assistant managing director. **Mr. H. West,** M.I.E.E., M.I.Mech.E., assistant chief electrical engineer, succeeds Dr. Dannatt as chief electrical engineer and is also appointed to the board of the company.

Dr. Dannatt received his technical education under Professor W. M. Thornton at Armstrong College, Newcastle, from which he graduated in electrical engineering in 1921. His studies were interrupted by the 1914-18 war, during which he served in the York and Lancaster Regiment, attaining the rank of captain and being awarded the Military Cross at Messines Ridge in 1917. He joined Metropolitan-Vickers as a college apprentice in 1921 and in 1924 took charge of the Electrical and Magnetic Section of the Research Department. His activities were mainly concerned with engineering investigations and he became an authority on electrical measurements, especially in relation to magnetism and the behaviour of dielectrics. He is the author of numerous articles and papers to scientific and engineering societies and is principal author of "Electrical Power Transmission and Interconnection." In 1936 he was awarded the degree of Doctor of Science by the University of Durham. In 1940 Dr. Dannatt was appointed to the Chair of Electrical Engineering in the University of Birmingham, but at the request of the Admiralty he continued part-time activities with Metropolitan-Vickers; in the New Year Honours List of 1943 he was appointed O.B.E. for his contributions to naval gunnery. He returned to Metropolitan-Vickers in 1944, becoming deputy chief electrical engineer in 1945 and chief electrical engineer with a seat on the board in 1947.

Sir Arthur Fleming was born in 1881 and began his technical education at Finsbury Technical College, London. After gaining further experience at the Westinghouse Works, East Pittsburgh (U.S.A.), he joined the technical staff of the British Westinghouse Co. (now Metropolitan-Vickers) in 1902, where he has filled the position of director of research and education during the greater part of his fifty-one years' service. The outstanding work of the research laboratories under Sir Arthur Fleming's direction has included research in dielectrics, high voltage phenomena, creep of metals at high temperatures and pressures, the discovery of low pressure oils and greases and the development of continuously evacuated plant and apparatus. He was one of the pioneers of broadcasting in Great Britain and the first Manchester broadcasting station was installed in the Research Department under his control. On the education side he has for many years supervised the education and training of all grades of the company's apprentices (now totalling over 10,000). He holds the Faraday Medal of the Institution of Electrical Engineers and the Hawksley Medal of the Institution of Mechanical Engineers. He was appointed O.B.E. in 1918, and C.B.E. in 1920 for his work on submarine detection. In 1945 he was knighted for his services to education.

Mr. West was one of the earliest apprentices at Trafford Park to be awarded a company's scholarship, which took him to the Manchester College of Technology where he studied electrical machine design under Professor Mil-

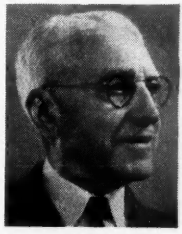
Sir Arthur Fleming

Dr. C. Dannatt

Mr. H. West

Walker. After a short period in the Intelligence Section of the M-V. Research Department, he joined the Motor Engineering Department, eventually becoming chief engineer, Motor and Welding Departments. Since 1935 he has served on a large number of Committees of the British Standards Institution, Electrical Research Association and the British Welding Research Association, and has travelled extensively on behalf of Metropolitan-Vickers in Europe and America. He has been assistant chief electrical engineer since November, 1949.

Mr. J. W. Bell, of the M-V Electrical Export Co., retired at the end of June, 1951, after over forty-eight years' service. He had been manager, Dominions Division, of the company from 1945 until 1st September, 1950. A cheque and an inscribed list of signatures from his colleagues were recently presented to him by Mr. J. F. Perry. Mr. I. R. Cox paid tribute to his work. Mr. Bell was also presented with a cheque and a letter of appreciation from the Long Service Association. Mr. Bell joined the old British Westinghouse Co. as a college apprentice in September, 1902, and spent a lengthy period on erection work, beginning with the early turbo-generators at Lots Road. Later he went to Bombay, Ghent, Copenhagen, and Australia. In Australia he was concerned with a variety of work in Victoria, in South Australia where M-V supplied the first sets in the Osborne power station, Adelaide, and in Western Australia where he was responsible for installation of power plant and the electrical gear on the Collie Coalfields. From 1927 to 1932 he was hon. secretary of the Adelaide Division of the Institution of Engineers, Australia. In 1932 Mr. Bell returned to England and joined the M-V Export Co., dealing with many large contracts for Australia, New Zealand, South Africa and the Rhodesias. Mr. Bell was the first vice-chairman of the I.E.E. Students' Section, Manchester, in 1904.



Mr. J. W. Bell

At a recent meeting of the Ripple Control Technical Committee, **Mr. N. Herwald,** B.Sc.(Eng.), A.C.G.I., A.M.I.E.E., was elected hon. secretary. His address is 130, Carlton Avenue West, North Wembley, Middx (telephone : Arnold 4225).

Mr. G. C. Thew, M.A., A.M.I.E.E., M.I.R.S.E., outdoor assistant to the signal and telecommunications engineer, has been appointed assistant signal and telecommunications engineer, North Eastern Region, British Railways, York. Mr. Thew, who was educated at Harrow and Cambridge, joined the L.N.E.R. as a graduate pupil in the Engineer's Department at York in 1929. He was closely associated with the resignalling work between York and Darlington.

Col. J. Reading, M.B.E., B.Sc.(Eng.), M.I.E.E., staff engineer in the General Post Office, has been appointed Assistant Engineer-in-Chief as from 1st October next. Col. Reading graduated at the Northampton Engineering College and after a period with the Radio Research Board was successful in the open competition for probationary assistant engineer and entered the Equipment Branch of the Engineering Department of the G.P.O. in 1925. He was promoted executive engineer in 1934 and assistant staff engineer in 1937. Col. Reading has been particularly concerned with the production of standard specifications for automatic exchanges. As chairman of the Post Office " Terms and Symbols Committee " he has represented the British Post Office and the British Standards Institution at many international conferences. His work in devising and introducing the routed schematic type of circuit diagram has been of considerable value in the field of telephone engineering. From 1935 to the outbreak of war he was managing editor of the *Post Office Electrical Engineers' Journal*; he has also been secretary of the Institution of Post Office Electrical Engineers since 1935.

Mr. C. L. Railton, A.M.I.E.E., A.M.Inst.W., who is in the Research Department of the Tube Investments group, was rescued with a companion, Mr. W. H. Little, from a cave in Swansea Valley last Monday, after being trapped by water for fifty-six hours. Mr. Railton is a member of the South Wales Caving Club.

Mr. B. H. Hornung, chairman and managing director of **Suflex, Ltd.,** is leaving by air on 6th September on a business tour to the Middle East, Pakistan, India, Ceylon, Singapore, Malaya, Australasia and the United States.

On 23rd August Mr. E. Braathen, manager of the Birmingham Sub-Area, Midlands Electricity Board, on behalf of the British Electricity Authority, made a presentation to **Mr. F. Owen,** a maintenance worker employed at a Sparkhill substation, in recognition of his action in saving the life of a switchgear inspector whose clothes caught fire.

Nearly 300 retired and present employees with more than twenty-five years' service with **George Kent, Ltd.,** visited the South Bank Exhibition and attended a celebration dinner in London on 25th August. At the dinner volumes containing an illuminated address and the signatures of all long-service employees

were presented to Comdr. P. W. Kent, chairman of the company, and Mr. W. G. Ardley, joint managing director.

The annual bowls match for the "A. N. Smith" cup between the **Liverpool Electric Cable Co., Ltd.** and its associate company, **Frederick Smith & Co.**, Salford, took place on 18th August. The cup, which was won by the Liverpool company, was presented by Miss M. McLean. Among those present were Miss L. Brown, Mr. H. Kay, Mr. P. Child and Mr. Daniels (captain) from Salford. The party from Liverpool included Mr. J. T. Frost (works manager) and Mr. J. R. Cox. After the match both teams, their wives and friends were entertained to tea and a social evening.

We referred in our last issue to the illustrated history of the company distributed by the **Micanite & Insulators Co., Ltd.**, to its employees, friends and customers to celebrate the company's jubilee. On 20th August, in the main works recreation hall, Major W. I. Anderson, chairman of the company, supported by Sir Arthur Fleming, deputy chairman, made and received presentations on behalf of the directors. About 230 employees were present.

Mr. H. A. Cooper, general manager, opened the proceedings and Major Anderson expressed regret that Major Stanley M. Mohr, the managing director, was for reasons of health unable to attend, but gave reassuring news of his progress. The chairman then presented cheques for £500 to the Foremen's Association and the Micanite Sports & Social Club, and Savings Certificates to the value of five guineas to every employee who had completed at least twenty years' service. He then accepted, on behalf of the directors, a twin pen writing set from Mr. W. Stevens, chairman, Long-Service Association, a silver cigarette box from Mr. W. Kear, vice-chairman, Foremen's Association, and two silver ash trays and a lighter from Mr. N. Underdown, secretary, Sports & Social Club: Sir Arthur Fleming then addressed the gathering and Mr. D. J. Greene, works manager, also spoke.

OBITUARY

Mr. W. S. Lonsdale.—The death occurred on 20th August at the age of sixty-seven of Mr. William Stanley Lonsdale, M.I.E.E., who was for many years manager of the south western territory of the English Electric Co., Ltd. Mr. Lonsdale commenced his career in the Experimental Department of Siemens Bros. Dynamo Works, Stafford, in 1905, and later went East as manager, first of the Penang Branch and subsequently of the Rangoon Branch. He opened a new branch and business for the Siemens companies in 1911, and returned to London in the following year as London representative for Siemens' Central Station and Power Department. After service in the 1914-18 war he became sales manager, London and the South, of the English Electric Co., Ltd. He was appointed assistant export manager of the company in 1929 and became its manager for the south western territory in 1932.

Mr. J. P. Chittenden.—The death is also reported (on 20th August) of Mr. John Picton Chittenden, M.I.Mech.E., M.I.Mar.E., A.M.I.E.E., who was for many years associated with the English Electric Co., Ltd., with whom he played a prominent part in steam turbine development.

The late Mr. J. P. Chittenden

Mr. Chittenden, who was seventy years of age, after serving as a student at the Barrow works of Vickers Maxims, joined the drawing office staff of the Wallsend Slipway & Engineering Co., Ltd., and assisted in the design of the steam turbines for the *Mauretania*. In 1906 he joined the drawing office staff of Willans & Robinson at Rugby, later incorporated as part of the English Electric Co., Ltd. Later he was transferred to the Turbine Design Department, and in 1912 became chief turbine designer, subsequently becoming chief engineer of the Steam Turbine Department. In this capacity he was intimately connected with the expansion of the company's steam turbine business, and was directly responsible for many of its developments. In later years, owing to ill health, he took a less active interest in this work, but continued to act as consulting engineer to the company until his retirement in 1946. He had written extensively on steam turbine development, and in 1928 was awarded the Paris Premium of the I.E.E., for a paper on "High Steam Pressures and their Application to the Steam Turbine."

Mr. Harold Gilbert Brown, former managing director of Westinghouse Brake & Signal Co., Ltd., whose death we reported in our last week's issue, was born in Boston, Massachusetts, in 1875. After serving some years in the Boston power station and tramway system and the Boston Elevated Railroad, he joined the Westinghouse Brake Co., of London, which carried out the power signalling in connection with the electrification of London's Underground Railways, first in the capacity of outside supervisor. He invented the system used and also the train description subsequently installed. In 1907 the McKenzie

Holland & Westinghouse Power Signal Co., Ltd., was formed to take over the power signalling work of McKenzie & Holland, the Westinghouse Brake Co., and the Consolidated Signal Co., and Mr. Brown was appointed the first chief engineer. In 1914 he became general manager and in 1916 managing director. As a member of the Institution of Electrical Engineers he was the author of a paper " The Signalling of a Rapid Transit Railway " read before the Institution in 1914, which subsequently became the basis of English power signalling practice. He joined the board of the Railway Signal Co., in 1919 and was chairman from 1932 to 1938. He was also a director of a number of British and overseas companies. When the Westinghouse Brake & Saxby Signal Co., Ltd., was formed in 1920 Mr. Brown was appointed managing director. He retired from executive office in 1934 and from the board in 1945.

Mr. W. M. Lydall.—The death was reported in our last issue of Mr. W. M. Lydall, M.I.E.E., chairman and managing director of the Yorkshire Electric Transformer Co., Ltd., which he founded in 1925. Mr. Lydall was born at Meltham, Yorks, in 1887 and was educated at the Huddersfield Technical College. He was well known as a consulting engineer, in which capacity he represented the Brush Electrical Manufacturing Company, the Devonport Engineering Co., Citröen Gears, Ltd., etc., and he was responsible for many of the early electrical installations in Yorkshire textile mills. He was Vice-Commodore of the Windermere Motor Boat Racing Club, a member of Ulverston Rural District Council and a well known freemason.

The late Mr. W. M. Lydall

Mr. T. H. Steadman, whose death occurred at the age of eighty-one on 31st July, was in the Ships Electric Installation Department of Harland & Wolff, Ltd., Belfast, from its inception until his retirement in 1936.

WILLS

Mr. William John Bensley, late deputy managing director of the Sloan Electrical Co., Ltd., and president of the Electrical Wholesalers' Federation, who died on 19th May, left £13,320 gross (£13,082 net).

Mr. F. C. Knowles, M.I.E.E., director and late sales manager of Evershed & Vignoles, Ltd., who died on 4th March last, left £18,013 gross (£17,890 net).

NEW BOOKS

Echo Sounding at Sea. By H. Galway. Pp. 299; figs. 115; index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 35s.

There are several good books on sound waves and their uses but not one of them, we believe, is devoted solely to echo sounding at sea and to the design and operation of the equipment required for this purpose. This deficiency is to a large extent remedied by the present volume, particularly as much of the information it contains has not previously been generally available.

Starting with an easily understandable introduction to sound waves and a discussion of the practical considerations involved in echo sounding the book continues in the simplest possible manner to deal with that all important factor, the selection of oscillator positions. It is upon the latter that the success or failure of the equipment depends but the author deals with the subject so well that if his recommendations are complied with little difficulty should be experienced.

After dealing in comparative detail with a large number of individual equipments Mr. Galway concludes with a comprehensive section on fault finding and maintenance. The book will undoubtedly be useful to students, ships' masters and navigating officers but more particularly to radio officers and others who use and may be called upon to service the equipment at sea or in port.—R.P.

Your Factory and the Law. By Francis W. Hunt, B.Sc. Pp. 147; index. Seven Oaks Press, Ltd., 165, Victoria Street, London, S.W.1. Price 15s.

The intricacies of the Factory Acts give rise to many queries with which the author of this book, from his many years' experience as one of H.M. Inspectors of Factories, has an intimate knowledge. His aim to assist industrial concerns to deal with these problems is well accomplished within the confines of a fairly slim volume which, although intended for reference, is written in a readable style. Marginal notes make it easy to refer to the Acts themselves and the different regulations. Welfare requirements and the various Codes for dangerous trades are listed in appendices.—H.W.

New Generating Plant

Increasing Conformity with Accepted Standards

OF the 13,000 MW of steam generating plant (285 turbo-alternators and 483 boilers) ordered under the constructional programme of the British Electricity Authority for 1946–56 (inclusive), 9,677 MW (191 turbo-alternators) is being installed in 53 new stations. Particulars given at the recent Joint Engineering Conference (*Electrical Review*, 15th June) by Mr. V. A. Pask (chief engineer, B.E.A.) indicate the trends of modern British practice.

Increased Standardization

The first five years, now ended, reveal increasing conformity with accepted standards with regard to capacity of units and steam conditions, 18 of the 29 stations (5,877 MW in total) being equipped with 30 and 60 MW 3,000 r.p.m. turbo-alternators. For the subsequent six years the number of machine ratings in 24 stations (3,800 MW on order) has been reduced from seven to three in 30, 60 and 100 MW units. Turbine steam conditions for the forty-six 30 MW sets included in the 1951–56 period are 600 lb/sq in and 800 to 910 deg F, with a feed temperature of 340 deg F. For the fifty-nine 60 MW and twelve 100 MW sets corresponding figures are 900 to 1,500 lb/sq in and 900 to 1,050 deg F with feed water at 380 to 430 deg F.

Five boiler frames provide 91·5 per cent of the steaming capacity of the programme as a whole. The range extends from 200,000–265,000 lb/hr (86 units) to 830,000 lb/hr (5 units) with 300,000–375,000 lb/hr predominating (176 units). Boilers of the last-named rating and above amounting to 102 million lb/hr or 72·3 per cent of the total output of steam are at present envisaged as burning pulverized fuel, which gives immunity from bonded deposits on, and corrosion of, external heating surfaces.

Unit plants on the independent one boiler–one turbine principle are scheduled for 97 sets, 36 per cent of the kW capacity of the whole programme. This development is made feasible by the high annual availability of large modern boilers (now comparable with that of turbines) owing to a variety of causes discussed in the paper, especially a furnace configuration that permits moderate heat release per cu ft and a radiant heat absorbent tube surface that is enough to maintain a safe exit gas temperature in relation to fusion characteristics of the ash.

As high-head radiant boilers have a rate of water circulation that is more than ten times that of their steaming capacity, compared with six to eight times usual for forced-circulation boilers, natural circulation is in general use. Steaming economizers, evaporating 5 to 7½ per cent of the feed water, by permitting the feed temperature to approach the saturation temperature in the drum, obviate thermal contraction and disturbance to natural circulation. For large boilers the flash welded continuous-loop type gives freedom from bonded deposits with high-phosphorus coals. Some feed regulators incorporate steam and water-flow governing with an overriding drum level control as a safeguard against changes of water volume with rapid load variations.

Types of Superheater

Superheaters for two-shift operation are preferably of the horizontal self-draining type with a damper controlled by-pass and 30 per cent of the heat input at continuous maximum rating can be applied to the furnace in the second stage. For base-load stations a combination of pendant secondary and horizontal self-draining primary is more suitable. With primary and secondary superheaters of the pendant type, the heat input is limited to 16 per cent of the m.c.r. and entails intermittent firing. Pressure raising following a 30-hour bank may vary from 90 (with gas by-passing) to 240 minutes, depending on the type of superheater.

Possible alternative methods of firing are provided by spreader stokers with grit refiring for 300,000 lb/hr boilers and cyclone burners for greater capacities. Of the former 500 MW is being installed; its chief

merits are freedom from bonded deposits and flexibility due to very rapid response to changes in rates of evaporation. The cyclone furnace, which is being installed on a 540,000 lb/hr boiler, operates at about 3,200 deg F and 83 per cent of the ash from 2in crushed coal is liquefied and then quenched for disposal in a solid state. After allowing for 7 per cent shrinkage in the iron compounds, only 10 per cent of ash (below 10 microns) traverses the furnace and convective passes, compared with 75 to 85 per cent for p.f. in a dry-bottom furnace and 55 to 65 per cent in a slag-tap furnace.

Turbine Construction

Nearly all turbines of 30 MW have two cylinders and those of 60 and 100 MW three cylinders, but designs with one cylinder fewer in each case are becoming available. Double casings for the high-pressure cylinder are being evolved with the space between in communication with the intermediate pressure stages; the inner casing can thus be built in sections of alloys suitable to the temperatures. Means for measuring differential expansion between rotors and casings of the h.p. and i.p. cylinders and eccentricity of rotors are often employed for large machines. Pressure-operated load pay-off and trip gear for governors of large sets, especially when arranged on the unit system, is under consideration; relays partly close the governing valves on fall of steam pressure to a predetermined limit and reopen them for faults of short duration, but trip the emergency valve for a heavy drop in steam pressure. General practice now is to use a vacuum-operated bellows relay, which closes the governor valves temporarily if the vacuum falls to 25in and trips the emergency valves if the vacuum falls further to 15in. Some large sets are being fitted with anticipatory overspeed limiting gear; on sudden loss of load a wattmeter relay, which measures the generator load, causes immediate closure of the valves.

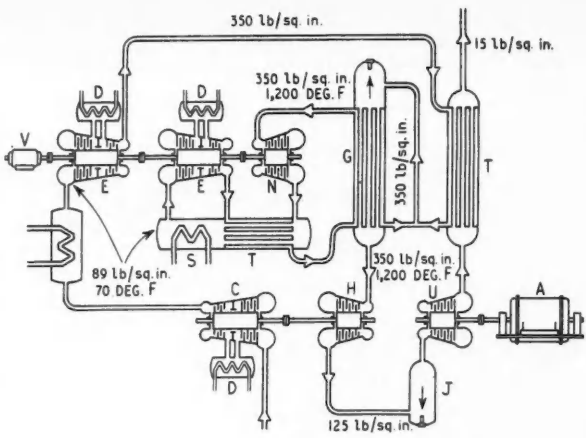
The 30 MW turbines have nozzle or by-pass governing gear with the economic point at 80 per cent m.c.r. Larger turbines are usually full-admission machines with economic points at m.c.r.; this permits of shorter and more symmetrical h.p. cylinders, less complicated control valves and governor gear and ensures very small changes of temperature in the h.p. and i.p. cylinders over a wide range of load. In two stations only are reheat turbines to be installed. Two-pass condensers are commonly used for river and estuary stations and three-pass where cooling towers are employed. In some of the 1,500 lb/sq in and 1,050 deg F stations Le Blanc rotary air pumps are being installed to reduce the cost of small-bore piping required by steam air ejectors. Preferred feed trains are: for 30 MW plants (600 lb/sq in), two l.p. and two h.p. heaters with a final feed temperature of 335 $\pm$ 10 deg F; for 60 MW plants (900 lb/sq in), two l.p. heaters, de-aerator and two h.p. heaters and final feed at 375 $\pm$ 10 deg F; for 100 MW plants (at present) two l.p. heaters, de-aerator and three h.p. heaters and 410 $\pm$ 10 deg F.

Two open-cycle 15 MW gas turbines are to be commissioned this year by the B.E.A. and one closed-cycle turbine of 12·5 MW by the North of Scotland Hydro-Electric Board. General descriptions have appeared in the *Electrical Review*. Mr. Pask also gives some particulars of a Swiss 20 MW three-line mixed-flow cycle plant at Weinfelden, in which rather more than half the air passes through a closed supercharging circuit and the remainder through an open-cycle power producing circuit. Air from the open-cycle h.p. compressor (see diagram), before reaching the combustion chamber of the air boiler, is preheated in the gas-air regenerator by the exhaust from the l.p. power turbine. The gaseous products of combustion heat the closed-cycle air going through the tube nests to 1,200 deg F before admission to the air turbine, but the injection of fuel oil is so regulated that the temperature of these gaseous products is maintained at the same figure on entering the h.p. open-cycle turbine. As the combustion is internal and only 50 to 60 per cent of the heat released in the combustion chamber of the air boiler is transmitted through the tube nests—the balance passing on to the h.p. turbine—it is claimed that this equipressure boiler is far smaller than the boiler of a normal closed-cycle unit and that efficiencies of about 30 per cent are attainable with a comparatively simple plant.

Exploitation of Water Power

Water power exploited before the constitution of the North of Scotland Hydro-Electric Board in 1943 amounted to 320 MW in Scotland and 50 MW in Wales.

The Board has ordered 56 turbines totalling 630 MW for installation by 1956, of which 78 per cent are vertical Francis, 10 per cent Kaplan and 6·70 per cent Pelton types. The largest now on order are, respectively, 40 MW (965ft head), 20 MW (188ft head) and 30 MW (1,365ft head). The trend is to control the hydro stations in groups from central points where the operation and maintenance staffs are accommodated. Schemes under consideration include 300 MW in Wales. The economics of pumped storage for 100 to 400 MW peak loads is being investigated.



A 20 MW mixed-cycle, three-line gas turbine

A. Electric generator. C. Low-pressure compressor. D. Intercooler. E. High-pressure compressor. G. Main combustion chamber with air heater. H. High-pressure turbine. J. Secondary combustion chamber. N. Air turbine. S. Recooler. T. Regenerators. U. Useful output turbine. V. Electric starting motor

The paper includes a historical survey of power production in the world from 1850 and an estimate of future developments including combined gas and steam cycles. A proposal under consideration is the use of an open-cycle gas turbine as an air pre-heater to a steam boiler for increasing the overall efficiency of the combined cycle. As a high rate of excess air is necessary to keep gas-turbine temperatures down to permissible values, most of the oxygen in the air is unburnt in the exhaust gases (which may be at 700 to 1,100 deg F) and can be used as combustion air in the boiler furnace at about atmospheric pressure. In another scheme being investigated an open-cycle gas turbine driving a compressor and electric generator is used as a supercharger for a "pressurized-combustion" boiler, which would materially lower dimensions and capital cost as well as improving overall efficiency.

Destruction of Soil Pests

EXPERIMENTS being carried out in Southern Rhodesia in the destruction of soil pests by high-frequency currents have impressed Dr. F. A. Stinson, a Canadian scientist who has been appointed Director of Tobacco Research in the colony. Dr. Stinson told the council of the Rhodesia Tobacco Association that he did not think it would kill off beneficial organisms as the frequency was selective. In the near future a report should be available on the field experiments conducted in the past year.

The ultimate aim is to construct a compact unit for attachment to farm implements. When infected lands are ploughed or harrowed, the nematodes in the soil will be destroyed automatically. In a test carried out on tobacco-seed beds, 71 per cent of all plants were found to be free of eelworm after electrical treatment, but in neighbouring untreated beds only 17 per cent of plants were free of infestation. The possible application of the system to the sterilization of milk and the elimination of pests other than nematodes is now being investigated and its effect upon the growth of plants is being studied.

Radio and Television Show

Latest Trends in Design Seen at Earls Court

By W. E. MILLER, M.A., M.BRIT.I.R.E.

THE National Radio and Television Exhibition, which opened on Wednesday last and continues until 8th September, is the eighteenth of the series and is being held for the first time at Earls Court, London. Last year the Show was held in Birmingham and in 1949 and previous years was at Olympia, from which the name "Radiolympia" was coined. Earls Court, the new "home" for the radio industry's annual autumn Show, provides ample space for the exhibitors and enables visitors to examine the various products in comparative comfort.

As in the past, the purely trade stands are supplemented by a number of exhibits of a more general nature, including those of the British Broadcasting Corporation, the Admiralty, the Air Ministry, the Department of Scientific and Industrial Research, the General Post Office, the Ministry of Civil Aviation and the War Office.

The Radio Industry Council, which has organized the exhibition, has built for the B.B.C. an elaborate television studio, 90ft by 60ft, with glass windows along three of its sides. From this studio a number of television programmes are being originated and are then radiated not only throughout the Show, but from the B.B.C. transmitters at Alexandra Palace and Sutton Coldfield. At the Show the public may inspect the operation of the studio and also hear the sound output, including the producers' instructions during rehearsals.

Services Equipment

The Admiralty exhibit includes a representation of the bridge of a modern cruiser, with its various radio aids. The R.A.F. also shows some of the latest radio and radar equipment used in fighter and bomber aircraft. The D.S.I.R. is stressing the importance of ionospheric recording in short-wave communications, which enables the forecasting of optimum frequencies for the use of transmitters at a given time. Receivers tuned to the same broadcast on different frequencies show the accuracy of these forecasts. The effect of weather on long-distance television reception is also being demonstrated.

The General Post Office is showing the main causes of radio and television interference, and their remedies. Receivers for detecting and measuring this interference are shown, together with other representative G.P.O. electronic equipment. On the stand of the Ministry of Civil Aviation is a 15ft by 8ft model of London Airport, shown for the first time in this country. Last of the Government and Services exhibits is that of the War Office, with displays by the Royal Corps of Signals and R.E.M.E. The various phases through which military signalling has passed are shown here.

Emphasis on Television

Turning to the trade exhibits, it is not unnatural that television is being stressed on the stands of the majority of receiver manufacturers. The impending opening in October of the third of the B.B.C.'s high-power transmitters at Holme Moss, which will serve the North of England, and the imminence of the opening of the first Scottish station at Kirk o'Shotts in the spring of 1952, have necessitated the introduction of receivers which can be used in any of the television regions.

The transmitter in each region is to operate on a different frequency, and manufacturers have tackled this problem in various ways. Some provide adjustable trimmers which can be set to receive the desired station when the receiver is installed. Others fit link devices to select the appropriate tuning circuits, while a third method is to supply interchangeable plug-in coil units for each station. In receivers which have no such devices it is usual to arrange for the radio frequency part of the circuit to be built on a small section of the chassis which is readily interchangeable for the reception of the different transmissions.

When television was re-introduced just

after the war, the majority of receivers used 9in or 10in direct-view tubes. In each succeeding year there has been a tendency to make the standard tube size 12in and this year there is no doubt that this has been achieved. Of the total number of different television receivers exhibited (about 120), 6·7 per cent only are 9 or 10in models, 66·7 per cent are 12in models, 15 per cent come in a group containing 14, 15, 16 or 17in tube models, while the remainder, about 11·6 per cent, are projection models of various kinds.

Apart from the actual tube sizes, there is this year a wider range of types than ever before. The standard circular-ended tube is now made with a shorter neck, enabling the depth of the cabinet to be reduced for a given tube size. This, of course, has necessitated a wider angle of sweep of the electron beam in the tube, which has increased the sweep voltages necessary, and has also introduced new problems in the design of deflection coils and circuits.

Some tube manufacturers have introduced so-called " metal " tubes, in which the conical glass portion of the normal tube is replace by a steel cone. In these, and in " all glass " tubes, the face on which the screen is deposited has been made more nearly flat than in the past. Another innovation in this country is the " rectangular " tube, in which the face of the tube is a rectangle of the standard 4 : 3 picture ratio. This also economizes in cabinet space, since the majority of the tube face is used for the picture.

Many tubes now have built-in or external " ion traps " which prevent heavy ions reaching the screen and producing the previously well-known " ion burn " defect on the screen. Alternatively, the screen is of the aluminized type, which also prevents ion burn. In general, the e.h.v. supplied to the tube has been raised, some direct-view tubes operating on 14 kV, compared with the 5 or 6 kV of a few years back. Brighter images are thus possible, and this permits the use of neutral grey filters in front of the tube face, which provide a better contrast in the picture under conditions of high ambient light in the viewing room. Viewing television in a completely darkened room should by now be a thing of the past.

The attempt to reduce the total number of valves used in a television receiver has resulted in the use of a number of dual types, particularly in the synchronizing, scanning and interference limiting circuits. It is probably in these circuits that the chief improvements have been made this year, with the object of providing a reliable interlaced picture, which is stable even in the presence of moderate amounts of impulsive interference. For this reason modern receivers in general can give better results in " fringe " areas of reception where the signal input is low, and interference levels may be high.

Projection television receivers, though they have increased in number, have certainly not begun to oust the direct-view type of set. This is probably because the latter type of set can provide a picture of adequate size for even large domestic rooms, quite apart from considerations of cost. Nevertheless, there are some interesting types of projection receivers at the Show, with flat screens ranging in size from about 13in by 10in to 19in by 14in. There is also one which projects on to a wall screen measuring about 4ft by 3ft.

Improvements in television aerials, which, of course, form an important part of the complete installation, lie mainly in the introduction of multi-arrays of various types for use under difficult conditions of reception.

Most of these are designed to have a narrow angle of reception, in order to cut out interference from other directions, as well as good pick-up qualities and accurate matching to the feeder used to connect them to the receiver.

Advances in Design Shown at Earls Court (*see opposite page*)

1.—A large direct-view television console, with a 16in tube, also providing reception of three pre-set radio stations, and facilities for receiving B.B.C. frequency modulated signals (*English Electric Co., Ltd.*). 2.—Many small plastic cased receivers are to be seen and this model, for a.c. or d.c. mains, is available in various pastel colours (*Pilot Radio, Ltd.*). 3.—One of the largest direct-view television receivers, incorporating a 16in tube (*Ferguson Radio Corporation, Ltd.*). 4.—A 12in television tube is used in by far the largest number of receivers at the Show. This console model is typical of those suitable for the average home (*General Electric Co., Ltd.*). 5.—Typical of a modern table radio receiver, this model covers three wavebands and is fitted with a high quality loudspeaker (*Ferranti, Ltd.*). 6.—There is a significant trend towards the use of table radiograms and this model provides a neat arrangement of the radio and gramophone sections (*Gramophone Co., Ltd.*). 7.—An example of a modern floor-console radiogram, incorporating an auto record-changer for ordinary and micro-groove (long-playing) records (*E. K. Cole, Ltd.*). 8.—Ease of maintenance is important in television receivers, and this shows one manufacturer's method of allowing the cabinet to be removed without disturbing the receiver itself (*Philips Electrical, Ltd.*)

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Ordinary radio receivers at the Show do not exhibit any marked changes in design. As in television receivers, use is being made almost exclusively of the latest ranges of miniature valves, as well as miniature components. Despite their small size, they are at least as efficient as much larger types of a few years ago.

Most modern radio receivers now have large and easily readable illuminated scales, and the majority include at least one short-wave range. More elaborate types use the now well-known "band-spread" system of providing an open tuning scale in those bands of the short-wave spectrum where most stations are found. This results in easy tuning and the possibility of accurate "logging."

On the whole, the quality of reproduction has shown an improvement. More care is taken in the circuitry and components to provide high fidelity audio-frequency amplification, and this is coupled with highly sensitive and well-designed loudspeakers, and more attention to the acoustic design of cabinets. Many manufacturers now cater for the high quality market by the provision of special loudspeakers and cabinets, and a.f. amplifier units of excellent performance.

In the small receiver class, plastic cabinets are largely used. Most of these sets are for a.c. or d.c. mains, and many of them work on dry batteries as well, merely by the operation of a switch. Battery portables, in the main, are of the "all-dry" class, and are mostly small in size and weight.

One new tendency to be observed at the Show is the apparent popularity of the table type of radio-gramophone. Since the war this type of reproducer has been introduced by many manufacturers, and at Earls Court there are numerous models which also include automatic record changing mechanism, and in some cases provision for handling ordinary and long-playing records. Most of the console radiograms are now of the automatic record changing type, with two- or three-speed motors. These also have interchangeable pick-ups for playing the ordinary (78 r.p.m.) and long-playing ($33\frac{1}{3}$ r.p.m.) records, the latter, of course, needing a much finer stylus point.

There are at the Show a few of the radiogram-cum-television-cum-cocktail bar luxury type of instrument, for which anything up to £500 may be paid. On the other hand, a good radiogram of the floor type need cost no more than £60 to £90. Several firms are exhibiting tape or wire recorders for domestic as well as professional use, and it appears that interest is growing in this type of equipment.

One interesting novelty at the Show is a dry battery "regenerator" which is claimed to extend by four or six times the life of dry batteries, and for which an N.P.L. certificate has been obtained. It is, in effect, a unit operating from a.c. mains which is periodically connected to a dry battery to reactivate it. Although the process has not been explained, it would appear to be associated with the freshening up of the depolarizer.

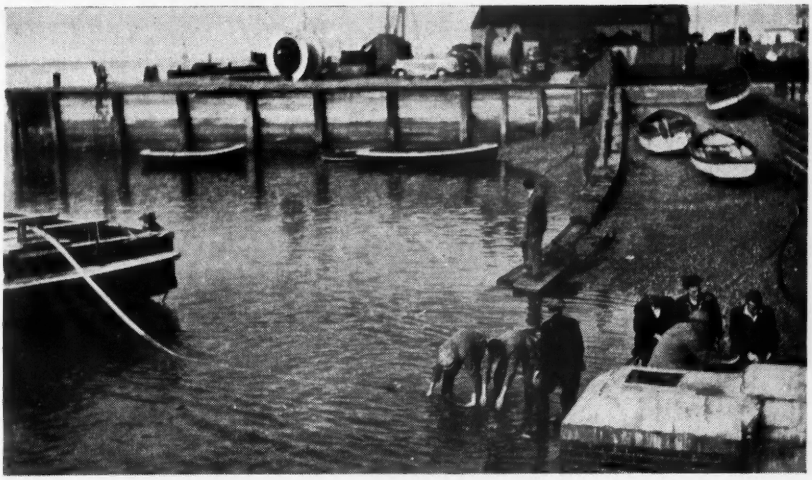
Another exhibit of interest is the use of "printed" circuits for radio or amplifier work, which eliminate much of the wiring and reduce the possibilities of bad contacts. In the same field is an amplifier unit in which all the components and wiring are actually moulded in a block of plastic measuring 2·1in by $1\frac{1}{2}$in by $\frac{3}{4}$in.

Leaving the actual exhibits, many of which it has not been possible to mention individually, attention should be drawn to a number of general exhibits and features. "Television Avenue" is, as its name indicates, a lengthy viewing corridor where television sets of every make can be seen working side by side. In addition, many manufacturers have their own demonstration rooms on the first floor.

Among the other exhibits, designed to show the importance of electronics in everyday life, are a radio-controlled ship, a motor launch equipped with radio and navigational aids, electronic equipment for detecting flaws in cloth, an encephalograph equipment for studying brain disorders and a radio factory assembly line.

Railway Signalling Relays

THE revision of the B.S. specifications for railway signalling relays has been taken advantage of for combining the provisions, which were very similar, of B.S. 520 and B.S. 557, so that the new B.S. 1745 applies to both line and track relays of the inductive type for a.c. circuits not exceeding 250 V and to relays with or without a local element. Copies of the new specification are obtainable from the British Standards Institution, 24, Victoria Street, London, S.W.1, price 2s post free.



Making the shore end fast at Aberdovey before the laying of the cable

Cable Under the Dovey

Connecting Two 11 *kV Networks*

A POWER cable has recently been laid across the estuary of the River Dovey from Aberdovey to Ynyslas to interconnect the 11 kV networks of Merionethshire and Cardiganshire in the South Wales Electricity Board's area.

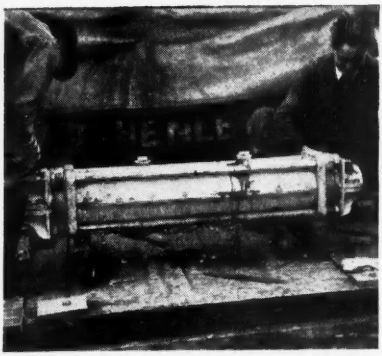
The 11 kV 0·1 sq in three-core p.i. and s.w.a. cable was laid by Contract Department engineers of W. T. Henley's Telegraph Works Co., Ltd. It was made in the company's works at Gravesend in two 1,320 yd lengths, each of which was coiled on to a drum, the gross weight of each drum being 15½ tons. The drums were delivered to Aberdovey by self-discharging lorries.

Craft had to be selected which would carry the weight but not draw more than 2ft 6in of water, the maximum that could be safely allowed to ensure clearing the sandbanks. A small landing craft lying at Caernarvon, from which the engines had been removed, was rigged for the purpose by Henley engineers and on the eve of the high-water spring tide the two lengths of cable were coiled into it.

The laying operations were begun from the Aberdovey side well before high tide to ensure the maximum depth of water over the sandbanks by the time the laying craft reached them. The shore end was pulled off and made fast and, as the tugs towed the craft, the cable was paid out, but after a few hundred yards the flood tide, flowing at 4½ knots, seemed likely to take the craft off course. It was therefore held in a fixed position until the flood tide slackened.

There was insufficient water for the two tugs to operate over the whole course, so three small motor boats controlled the laying craft when the tugs had grounded. Before this happened the first 1,320 yd length had been laid without difficulty.

The running end of the second length of cable was lashed to the end of the length already laid and the position marked by a buoy. The second length was paid out up



The completed 11 kV submarine cable joint

to a point 450 yd from the Ynyslas terminal pole when operations had to be suspended until the ensuing high tide enabled the laying craft to be taken much nearer to the Ynyslas terminal pole. A tractor ashore hauled the craft, on a midnight tide, as close inshore as possible until it grounded. The following morning the remaining cable was flaked off ashore and laid in a trench up to the terminal pole.

On the Aberdovey side the cable was buried in a 3ft deep trench excavated in the foreshore and covered with concrete bags down to low-water mark. On the Ynyslas foreshore the cable was ploughed in for about 1,000 yd.

The submarine joint which connected the two lengths of cable weighed some 8 cwt and it was therefore made in three stages on consecutive low tides, when the site it occupied was accessible by wading. At the first stage the end plates and the longitudinal rods were fitted and the wire armouring was made off. At the second stage the cores were jointed and insulated, and the split lead sleeve plumbed on to the cable sheaths and filled with compound. At the final stage the lead sleeve was topped up, the outer protecting shell fitted and filled with compound, and the completed joint buried in the sand.

The construction of an underground straight-through joint on the Aberdovey side and a pole terminal box on the Ynyslas side completed the 11 kV submarine cable link across the Dovey Estuary.

Street Lighting Notes

THE possibility of a complete changeover from gas to electric street lighting has been considered by the Finance Committee of the CHEPSTOW Urban District Council. The capital cost is estimated at £3,500 and the saving is put at £400 a year. The Committee has decided to ask the Electricity Board to prepare a scheme and estimates.

HEBBURN-ON-TYNE U.D.C. has accepted the estimate of the North Eastern Electricity Board at £309 for installing street lighting on the Campbell Park housing scheme extension.

STOCKTON-ON-TEES Town Council has received sanction to borrow £4,400 for the provision of electric street lighting on the Roseworth estate.

Fluorescent street lighting has been installed at TROWBRIDGE, Wiltshire. The lanterns used are the "Wilton Sieray 3480," each of which is fitted with three 80 W "Sieray" tubular fluorescent lamps operating on an instant start circuit. "Avenue 3 DN" reinforced concrete columns designed to carry the lantern were supplied by Concrete Utilities, Ltd. In one position a specially designed wall bracket was used to carry the lantern as the obstructions on the footpath did not allow a column to be used. The equipment for this installation was supplied by Siemens Electric Lamps & Supplies, Ltd., and the erection was carried out by the Southern Electricity Board, Melksham.

When a recommendation by the General Purposes Committee that a street lighting tender by the North Western Electricity Board should be accepted came before the KENDAL Town Council it was stated that the tender was the lowest of nine and that the figures showed that the tender was competitive with others. An opposing councillor objected to the acceptance of the tender on the ground that the Board should confine its attention to maintaining a supply of power at a low cost to the consumer. The tender, which covers the installation of 117 standards at a cost of £9,687, was accepted.

The WALLSEND Town Council has applied for sanction to borrow £2,450 for the provision and erection of 73 lamps at Low Willington Estate and three on the McNamara Road Estate.

TRING (Bucks) Council has agreed to buy the town's street lighting installation, the Eastern Electricity Board having intimated that because of restrictions on capital expenditure it wished to be responsible only for the supply of electricity, wiring and maintenance.

OVERSEAS ELECTRICAL TRADE

Exports Attain New Record in July

A BIG rise in the value of exports of electrical apparatus and machinery created a new record last month. The total at £14,810,138 is £2,486,035 above that for June and no less than £3,199,302 above the July, 1950, figure. As will be seen from Table I, the improvement compared with the corresponding month of last year was general throughout the whole range of products, the only items which did not record advances being telegraph and telephone cables and wires, accumulator parts and accessories, " other generating sets," traction motors, motors exceeding 250 h.p. and rectifiers for power house use.

Taken as a whole, shipments of electrical goods and apparatus increased in value

TABLE I.—ELECTRICAL EXPORTS

Class	July, 1951	July, 1950
	£	£
Telegraph and telephone cables and wires (submarine)	62,882	425,475
Ditto, not submarine	615,257	658,316
Wires and cables, paper insulated	536,219	387,189
Ditto, rubber insulated	524,237	332,415
Ditto, cotton, silk or artificial silk insulated	48,385	34,738
Ditto, enamel, glass or asbestos insulated	98,552	66,048
Ditto, other	236,094	130,730
Commercial radio apparatus	545,025	448,314
Domestic radio apparatus	446,742	234,377
Telegraph, telephone and signalling apparatus	1,560,280	1,489,515
Radio loudspeakers	56,952	42,289
Telecommunication components, n.e.s.	505,632	425,801
Other telecommunication apparatus	111,866	87,260
Valves and cathode ray tubes	355,950	249,405
Carbons	27,259	19,682
Lamps, exceeding 24 V	97,353	72,508
Ditto, not exceeding 24 V	38,684	33,531
Other lighting appliances	365,176	313,557
Primary batteries	241,465	164,461
Parts other than carbons	37,230	28,034
Accumulators for motor vehicles	248,306	175,291
Ditto, traction	30,000	6,016
Ditto, radio	5,369	1,392
Other portable accumulators	74,480	50,552
All other accumulators	66,558	18,630
Parts and accessories	63,626	75,616
Cooking appliances	282,815	113,660
Heating appliances	87,375	48,785
Parts and accessories for cooking and heating appliances	62,823	48,488
Flat irons	70,868	47,103
Commercial electrical instruments	118,949	106,000
House service meters	101,246	76,302
Time recorders and time switches	35,96€	17,748
Other electrical instruments	117,433	104,992
Electro-medical apparatus (not X-ray)	50,237	44,275
X-ray apparatus, tubes and parts	151,302	100,266
Permanent magnets	30,282	19,935
Insulating cloth and tape	111,362	80,573
Other insulating materials	100,168	80,537
Unclassified electrical goods and apparatus	573,333	405,595
TOTAL electrical goods and apparatus	8,893,738	7,265,401
Diesel driven generators not exceeding 200 kW*	479,853	453,966
Ditto, exceeding 200 kW*	189,121	90,135
Other generating sets*	128,580	364,858
Generators exported without prime movers, and parts of generators†	474,302	308,350
Motors, railway, tramway and trolley bus	3,291	6,600
Ditto, other, not over ½ h.p.	144,793	86,657
Ditto, over ½ h.p. but under 1 h.p.	54,778	29,998
Ditto, from 1 h.p. to 250 h.p.	501,218	367,741
Ditto, exceeding 250 h.p.	51,095	68,397
Ditto, parts	80,665	77,140
Converting machinery	23,251	16,010
Transformers, including coils	884,967	682,057
Rectifiers for power house use	25,582	69,887
Motor starting and controlling gear	181,927	148,129
Switchgear and switchboards (not telegraph and telephone)	1,114,448	818,283
TOTAL electrical machinery	4,337,871	3,588,208
Washing machines (not exceeding 250 lb weight)	606,484	307,778
Ditto, parts	21,351	8,734
Vacuum cleaners	266,130	207,035
Ditto, parts	44,634	34,419
Other electrically operated portable appliances and parts	252,929	95,834
Portable electric tools	116,085	77,550
Unspecified electrical machines, machinery and parts	270,916	25,877
GRAND TOTAL	14,810,138	11,610,836

* The 1950 figures include generators without prime movers

† The 1950 figures are for parts of generators only

by £1,628,337 over the July, 1950, figure. With each purchasing rather over £800,000 worth of apparatus, South Africa, India and Australia were again by far the best markets, the next most important being the Irish Republic (£549,209). Business in the dollar markets continued to improve, Canada's purchases rising from £195,331 to £281,718 and those of the United States from £61,715 to £129,207. In view of the situation in Persia it was perhaps to be expected that purchases by that country should fall; they declined from £94,615 to £14,111. Full details of the destinations of exported goods appear in Table II.

TABLE II.—Distribution of Electrical Goods and Apparatus

Destination	July, 1951	July, 1950
	£	£
Channel Islands	43,918	32,843
Gibraltar	3,638	2,669
Malta and Gozo	9,485	24,286
Cyprus	38,931	11,494
British West Africa	147,362	118,817
Union of South Africa	818,256	578,637
Northern Rhodesia	27,033	47,980
Southern Rhodesia	97,334	81,193
British East Africa	262,732	131,214
Bahrein, Kuwait, Qatar and Trucial Oman	59,298	27,441
India	817,419	388,145
Pakistan	252,175	272,872
Malaya	330,234	262,556
Ceylon	116,781	55,546
Hong Kong	148,720	96,045
Australia	810,698	983,375
New Zealand	247,723	268,964
Canada	281,718	195,331
British West Indies	114,295	97,782
Anglo-Egyptian Sudan	15,190	47,393
Other Commonwealth Countries	88,610	75,700
Irish Republic	549,209	284,696
Soviet Union	5,185	30,296
Finland	42,552	35,321
Sweden	370,559	225,954
Norway	228,622	94,274
Iceland	34,925	5,688
Denmark	127,265	430,949
Poland	72,217	16,959
Germany	21,167	22,820
Netherlands	294,403	244,270
Belgium	117,867	85,976
France	82,122	167,144
Switzerland	59,299	30,666
Portugal	151,679	179,509
Spain	25,159	9,648
Italy	105,660	38,119
Austria	79,605	87,213
Hungary	3,565	8,613
Czechoslovakia	41,395	3,125
Greece	98,536	99,093
Turkey	171,826	28,917
Indonesia	21,277	20,407
Portuguese East Africa	5,962	4,823
Syria	19,984	16,718
Lebanon	18,310	19,603
Israel	56,012	34,281
Egypt	172,712	202,311
Arabia	23,058	8,794
Iraq	19,087	34,791
Iran	14,111	94,615
Burma	38,896	82,224
Thailand	36,017	15,994
China	6,404	1,056
United States of America	129,207	61,715
Colombia	10,779	14,458
Venezuela	110,474	62,457
Peru	91,912	63,928
Chile	39,433	14,881
Brazil	244,102	210,533
Uruguay	22,797	17,700
Argentine Republic	168,394	263,753
Other Foreign Countries	230,443	90,826
Total	8,893,738	7,265,401

An analysis of individual items shows that the Irish Republic (£144,185) was slightly ahead of South Africa (£139,860) as the biggest purchaser of telegraph and telephone cables other than submarine, while Australia, India and South Africa between them accounted for a large amount of the other types. Egypt was sent £51,911 worth of paper insulated cable.

Of the commercial radio equipment exported (£545,025) India bought £122,069 worth and Sweden £103,857. Overseas purchases of domestic radio sets were practically doubled. Greatly increased buying of telegraph and telephone equipment by South Africa (£197,550 against £93,599), British East Africa (£106,464 against £7,120), the Irish Republic (£103,353 against £42,401) and Brazil (£103,274 against £11,309) more than made up for the decline from £469,118 to £245,833 in shipments to Australia. Malaya (£42,803) headed the list of accumulator purchasers.

British-made cooking and heating appliances continue to gain in popularity, exports in July at £433,013 being more than double those of July last year (£210,933). Australia (£137,868) was the largest customer.

An interesting feature of the electrical machinery exports is that Canada (with £198,798) was second only to Australia (£253,225) in purchases of generating plant. Russia's share dropped from £208,245 to £96,388. Australia also received the greatest quantity of motors and other electrical machinery.

Imports of electrical goods and apparatus were valued at £622,911 compared with £396,708 in July last year. The biggest suppliers were the Netherlands (£223,451) and the United States (£107,314), the most important items being valves (£168,837) and radio, telecommunication and electronic apparatus (£138,720). Imports of generators fell in value from £28,987 to £15,862 but there were larger purchases of motors (£38,820 compared with £18,336) and other electrical machinery (£39,789 against £14,876).

Large Three-Phase Generators

High-Speed Demagnetization of Field

By T. F. WALL, D.SC., D.ENG., M.I.E.E.

SOME years ago a disastrous fire broke out in a large power station and the flames spread so that the transformer tanks cracked and the burning oil flooded the ground. The Fire Service could not act immediately because the whole place was electrically alive and all that could be done was to wait until the machine had run to a stand-still, thus making it electrically dead. Since it takes a large generator about 20 to 30 minutes to run down to rest, the fire proved to be a major catastrophe.

At first sight it might be thought that the obvious way to make the system dead was to open the field circuit. Owing to the immensely large electro-magnetic energy which is stored in the field of a big generator, however, any attempt to open this circuit by simply switching off the supply current would be disastrous.

In consequence of this necessity to provide means for opening the field circuit with the greatest possible speed when such an emergency arises, many attempts have been made to provide special devices for the purpose. The simplest and most effective of these will be briefly described and it should be noted that this device is applicable when the field of the generator is separately excited.

Fig. 1 shows a separately excited auxiliary machine connected to operate as a d.c. motor and supplied, for example, from a source of V volts, the switch S being used to control the armature current. When the switch S is closed, the armature current at any given moment t will be defined by the equation,

$$V = L\frac{di}{dt} + R.i + E_a \text{ volts} \quad .. \quad .. \quad (1)$$

where E_a is the induced back e.m.f. of the armature, L henrys is the inductance of the circuit, and R ohms is the resistance of the circuit.

Since the machine is separately excited, the field flux Φ c.g.s. lines will be constant, and the induced e.m.f. E_a will be proportional to the angular velocity ω, so that,

$$E_a = k.\omega \text{ volts} \quad .. \quad .. \quad .. \quad (2)$$

where k is a constant.

If $\mathcal{J}$ kg.m^2 is the moment of inertia of the armature, the kinetic-energy at any given speed ω will be $\frac{1}{2}\mathcal{J}\omega^2$ joules, and if there is no friction loss, and no resisting torque, the electric energy supplied to the motor will be wholly utilized in accelerating the armature, so that, in the notation of the calculus,

$$E_a.i.dt = d(\tfrac{1}{2}\mathcal{J}\omega^2) \quad .. \quad .. \quad .. \quad (3)$$

From these three equations (1), (2) and (3), the following equation has been derived, viz.,

$$\boxed{L\frac{d^2i}{dt^2} + R\frac{di}{dt} + \frac{k^2}{\mathcal{J}}i = 0} \quad .. \quad .. \quad (4)$$

Now if this equation is compared with the standard equation* for a circuit consisting of inductance, resistance, and capacitance in series, it will be seen that

the factor $\frac{k^2}{\mathcal{J}}$ *is equivalent to a static capacitance of magnitude* $\frac{\mathcal{J}}{k^2}$ farads.

That is to say, the circuit system of Fig. 1 operates exactly the same as it would if the armature were to be replaced by a static condenser of magnitude,

$$C = \frac{\mathcal{J}}{k^2} \text{ farads.}$$

To take a *numerical example*, if $\mathcal{J} = 1$ kg.m^2,

* "Principles of Electrical Engineering," by T. F. Wall, page 316.

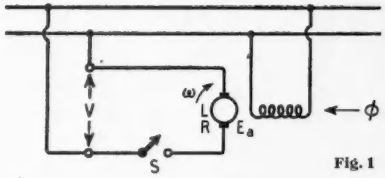


Fig. 1

the normal speed of the machine M is 1,500 r.p.m., and at this speed the induced e.m.f. is $E_a = 100$ volts, so that $k = \frac{E_a}{\omega} = \frac{100}{2\pi 25} = 0{\cdot}64$, the equivalent capacitance is $C = \frac{\mathcal{J}}{k^2} = 2{\cdot}45$ *farads*.

It is thus seen that the equivalent of an enormously large electrostatic condenser can be obtained in this way.

The application of this capacitance effect for the purpose of demagnetizing the field of a large three-phase generator can be seen by reference to Fig. 2. In this case, the inductance of the generator field circuit is L henry, where $L.I = \frac{w\Phi p}{10^8}$. In this expression I amp is the current in the field of the generator at the moment when the switch S is opened, Φ c.g.s. lines is the corresponding flux, and w the number of turns in series per pole of the field coils, the number of pole-pairs being p.

The electro-magnetic energy stored in the field of the three-phase generator will be $\frac{1}{2}L.I^2$ joules, and if there were no resistances in the field circuit, then when the switch S is opened and the current becomes zero, the whole of this energy will have become transferred to the equivalent condenser, that is, to the kinetic energy of the rotating armature M.

If E_{max} is the p.d. across this equivalent capacitance, the stored energy in the rotating armature at that moment will be $\frac{1}{2}E^2_{max}C$ so that $\frac{1}{2}E^2_{max}C = \frac{1}{2}L.I^2$, that is, $E_{max} = I\sqrt{\frac{L}{C}}$ or, since $C = \frac{\mathcal{J}}{k^2}$, therefore $E_{max} = I\sqrt{\frac{L.k^2}{\mathcal{J}}}$ that is, $E_{max} = k\sqrt{\frac{w.\Phi.p.I}{10^8\mathcal{J}}}$

This result is obtained under the assumption that the resistance of the field and armature circuit is negligible. The effect of the resistance is to reduce the value of E_{max}. If the back e.m.f. is E_o when the speed of the motor M is n_o, then $k = \frac{E_o}{\omega} = \frac{E_o}{2\pi n_o}$ and $E_{max} = \frac{E_o}{2\pi n_o}\sqrt{\frac{w\Phi pI}{\mathcal{J}.10^8}}$ and the maximum speed which the motor will then attain is

$$n_{max} = \frac{E_{max}}{E_o}.n_o$$

so that the motor M must be designed to stand this speed.

In this way, the use of a separately excited d.c. machine makes it possible to completely demagnetize the field system of the largest three-phase generators in from 12 to 13 seconds. The small current which will then pass through the armature of the d.c. machine can be broken without any difficulty.

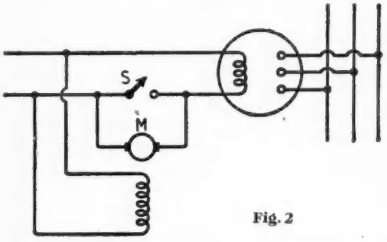


Fig. 2

Progress in Toronto

SALES of electricity by the Toronto Electric Commissioners for 1950 amounted to 1,915·4 million kWh, as compared with 1,698·5 million kWh for 1949, and the peak load reached 420,203 kW (against 345,520 kW). The gross operating income amounted to $19,679,388; and after deducting $11,362,232, cost of electricity purchased from the Hydro-Electric Power Commission of Ontario and $4,830,155 operating expenses, the net operating income was $3,487,000, net income carried to surplus account is $1,653,552, of which $1,600,000 has been allocated for frequency standardization.

The regulations made in respect of the use of electricity were suspended in June, 1950, following the bringing into service of the Des Joachim's plant. After the commencement of hostilities in Korea the load began to rise rapidly, and at the request of the Commission, the City Council passed a by-law extending the daylight saving period. In connection with the scheme of frequency standardization, the Hydro-Electric Power Commission of Ontario constructed a 60 c/s steam plant of 20,000 kW at Ashbridge's Bay. A terminal station at Gerrard and Blackburn Streets was also erected which was connected by 26,000 V overhead feeders to Scarboro frequency changer station, and by underground 13,200 V feeders to Ashbridge's Bay. This was brought into service in December, 1949. The supply to the Toronto Transport Commission's Beaches and Sumach stations was then changed over to 60 c/s. Other areas of the City were also changed over and at 31st December last the total load supplied in the City at 60 c/s was 10,335 kW.

Modern Brick Making

Haulage and Treatment of Excavated Clay

WE have already described how Oxford clay is procured from the large quarry at the Stewartby works of the London Brick Co., Ltd., and brought in trucks to loading stations in and near the pit ready for transport to the works. This haulage is effected (see " Clay Winning," *Electrical Review*, 24th August, 1951) on the continuous principle, upward V-projections from the trucks engaging with overhead travelling chains. The system is in two sections: one from the first loading station at the main pit bottom level to the driving point at the same level about half a mile away and thence to an elevated position in the works convenient for tipping where there is the drive for the second section.

The driving equipment for the first section is in a special building, one compartment containing the motor and the primary power transmission equipment, and a second compartment containing the major and direct transmission gear to the haulage chain. One of the two English Electric 50 h.p., 665 r.p.m., 220 V d.c. motors is coupled to a David Brown spur gear from which a horizontal shaft goes through the wall to bevel gearing and finally to a vertical shaft at the top of which is a driving wheel engaging with the haulage chain. The other motor is a stand-by and is normally uncoupled. Both of these machines are contactor operated.

Sequence control of the two haulage sections is provided for in the following manner. The tail end of the second section drives a small generator that energizes a relay which, in turn, operates relays serving the motor contactors of the first section drive. Thus the first haulage section can only be started when the second section is running and ready to take the trucks

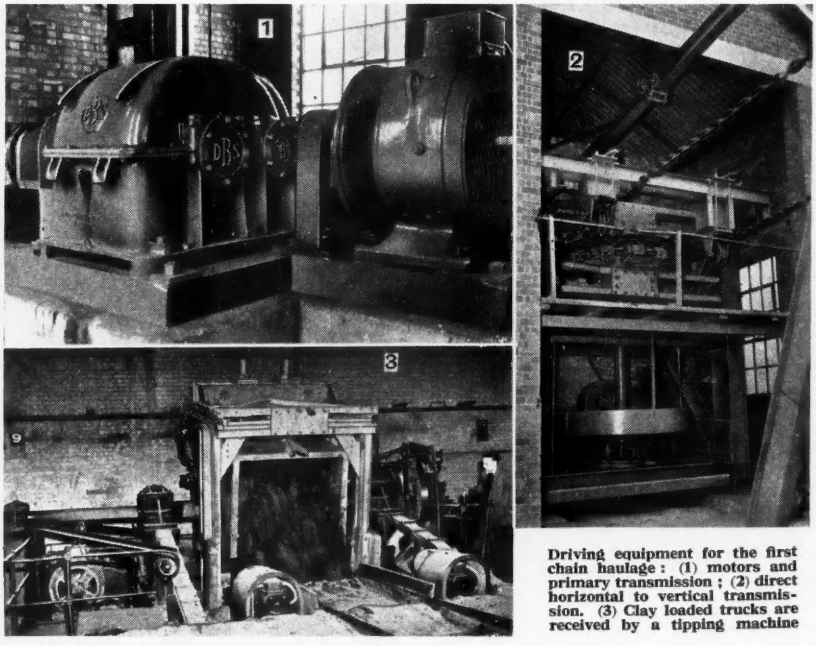
Above: **Each electrically-heated press has a load of 4 to 5 kW according to weather conditions.**
Below: **Transport of the clay from the pit to the works proper is effected by chain haulage**

from the first section. In connection with the pit extension we mentioned a second loading station. This is at ground level and there the diesel-pulled trucks are transferred to an auxiliary chain haulage system by which the trucks are passed to the first loading station from which they are taken by the two-section haulage system already described.

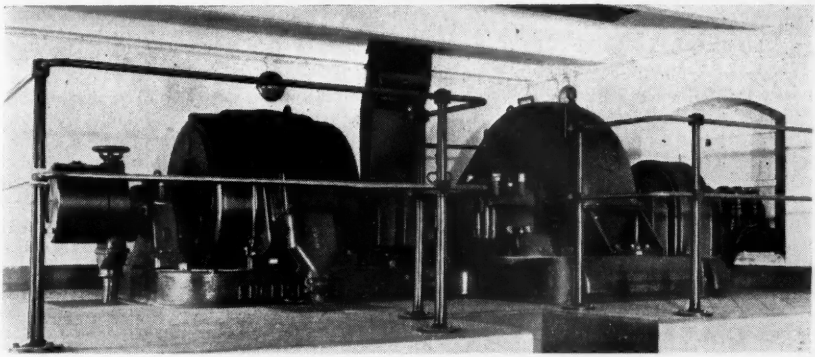
In the works proper the loaded trucks at the elevated position are received from the chain haulage system by tipping machines which travel on rails to and fro throughout the length of a pan shed, emptying the trucks into hopper towers which feed clay to the grinding pans.

The tipping machines collect d.c. at 220 V from bare overhead conductor gear. They are each equipped with a 30 h.p., 680 r.p.m. travelling motor and one of 5 h.p. at 620 r.p.m. which operates the actual rotary tipping unit. Both of these E.E. motors have drum type rotor resistance starters and the smaller runs constantly, the tippler cage being operated by engaging a friction roller. There is very wide ratio pinion reduction gear between the motor and the friction roller. The travelling motor has spur transmission gear on to the driving shaft. The trucks are automatically locked in the cage by spring operated catches and they are released by a B.T.H. thrustor.

From each hopper tower the clay is fed by reciprocating bottom plates to the grinding pans. These bottom plates are all individually driven by 5 h.p., 710 r.p.m., s.c. motors controlled by push-button operated contactors at the will of the pan attendant. Power transmission is through worm gear and roller chain to an eccentric shaft. There are many grinding pans, some individually driven and some group driven. To instance an individual drive, a 60 h.p., 730 r.p.m., s.r. motor mounted on a floor above transmits power down through V-belts to a horizontal shaft across the top of the pan, thence through bevel-pinion and crown gear to a vertical shaft which carries the revolving pan. The heavy grinding wheels are driven by frictional contact with the material in the pan. A typical group drive for twelve 9ft grinding pans is a 400 h.p., 736 r.p.m.,



Driving equipment for the first chain haulage: (1) motors and primary transmission; (2) direct horizontal to vertical transmission. (3) Clay loaded trucks are received by a tipping machine



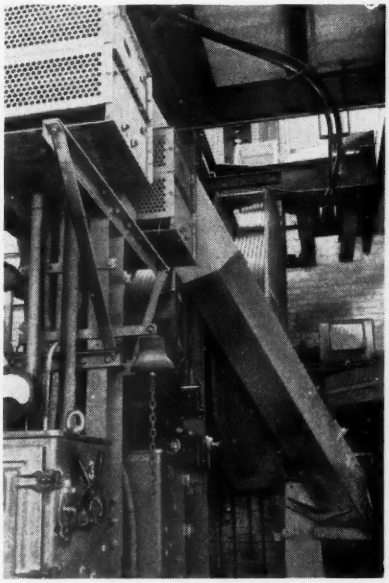
A 400 h.p., 6·6 kV motor group drives twelve grinding pans via reducing gear and a friction clutch

6·6 kV motor coupled through reduction gear and a friction clutch to the main shaft across the tops of the pans, this shaft carrying bevel pinions as for the individual drives. The tendency nowadays is to drive the pans individually.

The ground clay passes through the perforated base plates of the pans and falls into a collecting hopper from which it is transported by a bucket elevator to rotary screens near the top of the building. After screening, the clay is delivered on to a conveyor belt system for delivery to the press sheds. Generally the screens and elevators are included in group drives for pans and other machines, but in a few cases small group drives serve elevators and screens alone. Usually one elevator serves one single screen and takes its material from one pan. Included in the comprehensive conveyor system for the transfer of the ground clay from the screens to the press sheds is a 30in wide, 650ft long belt conveyor which is driven by a 25 h.p. vertically geared s.c. motor, the actual reduction ratio being 730 to 24 r.p.m. The final gear shaft is directly coupled to the conveyor head drum. The belt speed is 250 ft/min and the conveyor is capable of moving up to about 250 tons of ground clay an hour. The motor is star-delta started.

The material on this main belt conveyor system is ploughed off at various points on to subsidiary conveyor belts serving individual press sheds. In the latter are various group drives; in each of two cases a row of 15 presses is driven by an 80 h.p., 730 r.p.m. "No-Lag" motor with a leading p.f. of 0·8 with a drum type rotor starter and stator contactors. There is simple belt transmission to countershafts and similar secondary transmissions on to the individual machines.

In each case the ground clay is passed from the press hopper to the press charging box that serves the moulding chamber in which the bricks are shaped under



To an individually driven grinding pan power is transmitted from the motor on the floor above

mechanical pressure to size ready for transfer to the kilns. Generally the die plates of the presses at this particular works are steam heated, but in most of the associated works and in at least one case in this works the die plates are electrically heated. Each electrically heated press is loaded to 4 or 5 kW. The heating prevents the bricks from sticking to the dies.

From the press sheds the green bricks are taken to the kiln chambers by transfer cars hauled by trolley type electric locomotives operating at 220 V d.c., obtained from the works system which incorporates a number of rotary convertors, the largest being a 400 kW machine. Each locomotive has a single d.c., 20 h.p. series motor and a pantograph collector.

Special bricks for facing purposes are transported on 3 h.p. motor-driven belt conveyors to sanding machines in which sand is blown on to the bricks by compressed air through reciprocating nozzles driven by small geared motors. Associated small motor-driven conveyor systems transfer the bricks to setting points on grids from which they pass by fork trucks to the kilns.

Each of the latter has a number of chambers. They hold up to 40,000 bricks in the Hoffman kilns and 72,000 bricks in the car kilns, being interconnected by a system of flues and dampers which enable the bricks to be dried and pre-heated by the waste heat from the cooling burnt bricks in other parts of the kiln. The setting of the bricks in the kiln chambers and their withdrawal after burning has up to now been mainly a hand operation, but a method now being adopted is to set the bricks in bulk in the kilns by means of fork trucks. After leaving the kiln and careful inspection the bricks are ready for despatch.

Generally the lighting throughout the works is at 100 V, taken from transformers with secondary windings centre-tapped to earth. Track lighting in the quarry is by portable lamp stands. Certain press sheds now have fluorescent lighting.

We are indebted to the London Brick Co., Ltd., for enabling us to prepare this article.

(1) Included in the comprehensive conveyor system to the press sheds is a 650ft long 30in wide belt conveyor ; subsidiary conveyor drive left. (2) Small conveyors transfer special bricks from sanding machines to setting points. (3) Green bricks are taken to the kilns in cars hauled by electric locomotives. (4) Ground clay is elevated to rotary screens, generally group driven with other equipment

Commerce and Industry

Yorkshire Board Summoned

Inter-Services Battery Specifications

SUMMONSES have been issued against the Yorkshire Electricity Board, Mr. W. M. Lapper, the chairman, and Mr. F. Newey, the deputy chairman; they are returnable at Leeds on 25th September.

The Attorney-General told Mr. Bullus in the House of Commons on 23rd July that he had received a report alleging breaches of Defence Regulation No. 56A in connection with building work carried out by the Board at Scarcroft and Bramhope. A *prima facie* case had been disclosed and instructions had been given for proceedings to be taken against those responsible.

A.S.E.E. Exhibition

The recent success of the electrical exhibition of the N.W. London Branch of the Association of Supervising Electrical Engineers was raised at the Association's annual conference with a request for a national exhibition. The Association has approved the project and a committee has been formed with Mr. P. A. Thorogood as exhibition secretary, Mr. H. E. Butler as chairman, and Messrs. R. F. Mathieson and B. G. Aldridge as advisers. It was decided to hold this first exhibition at the New Hall at the Royal Horticultural Hall, Westminster, London, S.W.1, on 28th and 29th March next. B.E.A.M.A. is giving its support. Working exhibits will be encouraged, especially labour saving equipment, safety devices and peak load saving ideas. Invitations will be extended to the trade and Government Departments. Electrical manufacturers are invited to exhibit and should apply to Mr. Thorogood, at 35, Gibbs Green, Edgware, Middlesex.

B.I.F. Applications

The organizers of the Earls Court and Olympia sections of the 1952 British Industries Fair have extended the period for the receipt of applications for space from 25th August to 20th September.

Diesel Locomotives for Australia

The Commonwealth Railways, Australia, have placed an order for fourteen diesel-electric locomotives of 955 b.h.p. for general service on the 3ft 6in gauge Central Australian Railway. The main contractors are the Birmingham Railway Carriage & Wagon Co., Ltd., who will build the mechanical portion and deliver the complete locomotives. Complete technical responsibility is vested in Sulzer Bros., Ltd., and the diesel engines are to be supplied by Sulzer Bros. (London), Ltd. The complete electric transmission and control equipment is to be provided by Crompton Parkinson, Ltd.

Power Station Dispute

The Industrial Court was to meet yesterday to consider representations from the parties to the dispute which has led to a refusal of manual workers at more than thirty power stations to work overtime.

On Tuesday last week a number of shift workers at Barking failed to report for duty and because of the overtime ban substitutes could not be found. As a result a 75 MW set was idle during the afternoon and evening. The matter was considered at a meeting of the London District Joint Council for the Electricity Supply Industry on Thursday last week but no statement was issued.

Commonwealth Scholarship Scheme

Just arrived in Britain from New Zealand and India are the first two students to be awarded scholarships under the new Brush-Aboe Commonwealth scholarship scheme. The scholarships are worth over £800 in fares and allowances to each student, who, in addition, receives two years' free training in the factories of the Brush-Aboe group of companies. The scheme is designed to provide scholarships for engineering graduates from Australia, Canada, Ceylon, India, New Zealand, Pakistan, Rhodesia, Singapore and South Africa. As well as allowing for two years' study of the products and methods of production of the group, it is aimed at helping to widen the scope of the engineering profession and to strengthen the relationship existing between the United Kingdom and the British Commonwealth.

Plymouth Electric Club

A well attended meeting of members of the electrical industry was held at the Duke of Cornwall Hotel, Plymouth, on 25th June, to discuss the possibility of the formation of an Electric Club. The aims and objects of the Bristol Electric Club were explained by Mr. H. D. Denman, secretary of that club, and following some discussion it was decided to form a club and a committee was appointed to prepare draft rules. The inaugural meeting of the Club

will be held during October. The aims of the Club are to disseminate electrical knowledge, to provide a common meeting ground for all members of the electrical industry, and promote the work of the Electrical Industries Benevolent Association.

Radio Components Exhibition

The ninth annual private exhibition of British components, valves and test gear for the radio, television, electronic and telecommunication industries, will be held in the Great Hall, Grosvenor House, Park Lane, London, W.1, from 7th to 9th April, 1952. Admission will be by invitation only. Further details will be issued in due course by the organizers, the Radio and Electronic Component Manufacturers Federation, 22, Surrey Street, Strand, London, W.C.2.

E.C.A. Year Book

The "Electrical Contractors' Year Book, 1951–52" is now available from the Electrical Contractors' Association, Africa House, Kingsway, W.C.2 (price 10s, postage 1s). It is in similar form to the last edition and takes account of changes in membership, agreements, etc., which have occurred in the meantime. Mr. P. G. Wallis's presidential address, delivered at the Harrogate Conference in May, is reproduced.

Festival Window Display

A window display at the Birmingham district office of the British Thomson-Houston Co., Ltd., shows in miniature some of the company's exhibits at the Festival of Britain, including the 275 kV circuit breaker; the S/U/P/A projectors for the projection of stereoscopic pictures, the B.T.H. system of projected picture surround at the Telecinema, and the original Whittle-B.T.H. jet propulsion engine. In the Land Travelling Exhibition (at Birmingham from 4th–25th August) is a model of the B.T.H. gas turbine-alternator now being installed in the Anglo-Saxon Petroleum Co.'s tanker D.E.S. *Auris*, and the B.T.H. 16 mm sound-film projector.

A B.T.H. Festival display at its Birmingham district office

B.I.C.C. Bulletin

The summer number of the "B.I.C.C. Bulletin," published by British Insulated Callender's Cables, Ltd., is a special "Festival of Britain" number. It has an attractive cover in colour of the South Bank Exhibition and the contents include a number of excellent illustrations of features of the exhibition with details of the "Skylon," which was supplied and erected by the B.I. Callender's Construction Co. A number of cartoons from the national Press and referring to the "Skylon" are reproduced.

Educational

Part-time (day and evening) courses in engineering begin on 24th September at the Northampton Polytechnic, St. John Street, London, E.C.1. Enrolment commences on 12th September. The prospectus can be obtained on application to the Principal.

The Manchester and District Advisory Council for Further Education has issued a prospectus of courses provided during the 1951–52 session in electrical and mechanical engineering at the technical colleges within its area. The prospectus can be obtained from the hon. secretary of the Advisory Council, Education Offices, Deansgate, Manchester, 3.

"Handle With Care"

A year ago the Benjamin Electric, Ltd., produced some novel "Handle with Care" labels for all packages and crates in an effort to lessen breakages in transit. These proved so successful that the company has now designed three further amusing labels.

Overseas Students at Hoovers

Fifteen overseas students are at present working at the Perivale factory of Hoover Ltd. They come from Finland, France, Holland, Norway, Persia, Sweden and Switzerland. Many of them are on vacation from universities and technical colleges in their own countries and have been introduced through the international scheme for the exchange of university students, while others have come to the factory through arrangements made by the Hoover Export Department. Most will work in the factory for eight weeks but others will take longer specialized courses of study.

Crewe Cattle Market

Electric Panels, Ltd., inform us that the electric low temperature heating panels incor-

porated in the Crewe Cattle Market (*Electrical Review*, 17th August, page 323) are controlled by thermostats supplied by Robert McLaren & Co., Ltd.

Iron and Steel Scrap Prices

The Minister of Supply has made an Order (Iron and Steel Scrap (No. 4) Order, 1951) increasing the controlled maximum prices of iron and steel scrap from 27th August. The increase is £2 per ton except for compressed destructor scrap and two lower grades of unprepared process scrap. For these three grades the increase is 30s per ton. The purpose of the higher prices is to stimulate the collection of ferrous scrap. The new Order is regarded as fixing the maximum prices of ferrous scrap for some years ahead.

Apart from two special grades of iron, the prices of finished iron and steel are not being increased to consuming industries, but some adjustments are necessary, within the steel industry itself, in the prices of semi-finished steel. The Minister has made an Order accordingly (Iron and Steel Prices (No. 3) Order, 1951) which also took effect on 27th August.

Batteries for the Services

New standards for dry and inert Leclanché type primary batteries for use by the Services and Government Departments are laid down in the first of a new series of general specifications for Inter-Services equipment, to be published by the Ministry of Defence. The specification for batteries has been drawn up by the Defence Ministry's Engineering Standards Co-ordinating Committee. The main requirements for batteries for the Services is that they must be unaffected during storage, transport and operation by extreme climatic conditions in any part of the world. They must also be able to stand up to severe vibration and mechanical shock. Performance tests, for storage in temperate, jungle and desert climates, and discharge tests are laid down in the specification, and inspection procedures are also detailed. Under the provisions of the specification, all batteries must be marked indelibly with Inter-Service reference numbers, manufacturers' identifications signs and the date of manufacture. Copies of the specification (DEF-1—General Specification for Primary Batteries) are obtainable from H.M. Stationery Office, price 1s.

Electricity and Health

The great part electricity plays in maintaining the nation's health was demonstrated at an extensive health and safe food exhibition held at Dursley, Glos, last week. The exhibition, which lasted four days, was opened on 21st August, by Sir William G. Savage, of the Ministry of Food, who said it was the best of its kind he had seen. It consisted of a complete row of model shops, with the latest food storage equipment, dressed and run by local traders. There was also an ultra-modern bar complete with hygienic washing facilities and thermostatically controlled cabinets. Refrigerating equipment for most of the model shops and the bar was lent by J. and E. Hall, Ltd. Sadia automatic water heaters and the "Hotway" (Campbell Engineering Co., Ltd.) were demonstrated for supplying hot water for hand washing, together with the "Handy-Andy" warm air hand dryer. The Midlands Electricity Board had a stand with everything to make the kitchen and home clean and safe, and cooking demonstrations were given daily.

Electrical Commercial Travellers

A general meeting of the Electrical Trades' Commercial Travellers' Association is being held on Friday, 14th September, at the Feathers Hotel, Broadway, Westminster, S.W.1, at 6 p.m. This will be followed by an open session "Any Questions" at 7 p.m. (Question Master, Mr. H. A. Deacon, president). Ladies' night this year will be at the Café Royal, Regent Street, W.1, on Friday, 5th October, commencing at 6.30 p.m. On Thursday, 6th December, the Association's annual dinner-smoker will take place at the Windsor Castle Hotel, Victoria, S.W.1.

Welding Electrodes

A guide to selection and use of arc welding electrodes has been issued by the British Electrical and Allied Manufacturers' Association, 36, Kingsway, London, W.C.2 (publication No. 144—1951—price 2s) as a 44-page booklet. It includes a description of the British classification of coated electrodes (B.S. 1719) with advice on how to make use of it and a comparison of British and American code numbers. There are also outlines of the regulations and test requirements for securing Lloyd's approval, lists of relevant B.S. specifications and of mild steel electrodes manufactured by members of B.E.A.M.A., make, name, size, British and American code numbers, purpose and position for which they are approved by the Admiralty and Lloyd's.

Thorn Progress

To mark twenty-five years of trading Thorn Electrical Industries, Ltd., have issued an attractively produced brochure on the company's financial, research and manufacturing progress. It is a liberally illustrated record of plant engineering, lamp making, decorative lighting, electric cooking, radio and television activities.

Carbo-Nitriding Furnace for France

An order for a continuously-operating furnace installation for the carbo-nitriding of engine gear box parts has been placed with the General Electric Co., Ltd., by a firm of motor-car manufacturers in Paris. The furnace, which is the

first of its kind to be built in Great Britain, will be rated at 136 kW, and will give an output of 50 charges per hour, each weighing (with support) 15·4 lb.

Crypton Near-East Order

A large order has just been received from the Near East covering the supply of twelve Crypton B.100 motor analysers; forty "Portatest" portable electrical test sets, twelve multi-range electrical test sets, four heavy duty electrical test benches and three new distributor analysers. The total value of the order approaches five figures.

B.B.C. at Telcon Works

In the Home Service programme of the B.B.C. on 21st August the submarine cable factory described by Berkeley Smith, when the tug *Agama* sailed up the Thames from Gallions Reach to Tower Pier, was the factory of Submarine Cables, Ltd., owned jointly by the, Telegraph Construction & Maintenance Co., Ltd., and Siemens Brothers & Co., Ltd., at Telcon Works, Greenwich.

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £124 0s 0d
COPPER, H.C. Electro	ton £234 0s 0d
Fire Refined 99·7 per cent ..	ton £233 0s 0d
Fire Refined 99·2 per cent ..	ton £232 10s 0d
COPPER Tubes	lb 2s 2¾d
Sheet	ton £284 10s 0d
H.C. wire and strip	ton £261 15s 0d
LEAD, English	ton £181 10s 0d
Foreign	ton £180 0s 0d
MERCURY	flask £73 10s 0d
TIN	ton £1,000 0s 0d
ZINC, G.O.B. Foreign	ton £190 0s 0d
Electrolytic	ton £194 0s 0d
BRASS Tubes	lb 2s 1½d
Sheet	lb 2s 4½d
Wire	lb 2s 7½d
PHOSPHOR BRONZE	
Wire	lb 3s 6½d
RUBBER, No. 1 R.S.S. spot ..	lb 44½d–45d

Changes of Name

Adams-Wyborn, Ltd., have changed their name to E. J. Wyborn, Ltd.

Goodman Electric, Ltd., have changed their name to Radiant Electrical Engineers, Ltd.

Pakistan Government Contracts

The Government of Pakistan has announced its intention of considering for Government contracts only tenders of overseas concerns which have local representation. The Commercial Relations and Exports Department (Industries Branch) of the Board of Trade, Thames House North, Millbank, S.W.1, offers its services in the appointment of local agents by firms so far unrepresented in Pakistan. (Reference C.R.E. 10895/50.)

Trade Announcements

To give a better service to electrical contractors, retailers and works engineers in the Guildford area, the **Sun Electrical Co., Ltd.,** is opening a new branch at 15, Sydenham Road, Guildford, Surrey, on 3rd September, under the management of Mr. J. Firmin who has been representative in the area for a number of years.

E.M.I. Sales & Service, Ltd., announces that the **Columbia Graphophone Co., Ltd.,** for the first time since the war, is entering the radio and television field with a range of radio sets, radio-gramophones and television receivers. In the United Kingdom E.M.I. has nominated as its principal distributors Lombard Wholesale Supplies & Services, Ltd.

As from the 10th September, 1951, the address of the Dublin Office of **British Insulated Callender's Cables, Ltd.,** will be 53, South William Street, Dublin, C.1. The telephone number remains unchanged.

The London office of **Ferguson, Pailin, Ltd.,** has been transferred to Bush House, Aldwych, London, W.C.2 (telephone : Temple Bar 8711/2).

Catalogues and Lists

Simplex Electric Co., Ltd., Broadwell, Oldbury, Birmingham.—Steel conduit price list, effective 16th August, and five fresh pages for substitution in the serial No. WH 1813 "Creda" immersion water heater catalogue. The company has broken down its range of switch and fuse gear into : switches and switch-fuses, splitters, cutouts, "Monarch" gear, "Regent" gear, distribution boards, unit panels, etc. Accordingly the first of a new series of illustrated specification folders, which will replace switchgear list SW 1690, describes with dimensions splitters and splitter type switch-fuses for house service use.

Standard Telephones & Cables, Ltd., Connaught House, Aldwych, London, W.C.2.—Second edition of A/10 illustrated brochure describing the condenser cone for power cable-ends.

Marconi Instruments, Ltd., Longacres, St. Albans, Herts.—Catalogue entitled "Mastery of Measurement" which, while not including details of the company's complete range of products, well illustrates (including circuit diagrams) communication test gear, industrial measuring equipment and electro-medical apparatus.

Darwins, Ltd., Sheffield.—Catalogue containing technical data on permanent magnets.

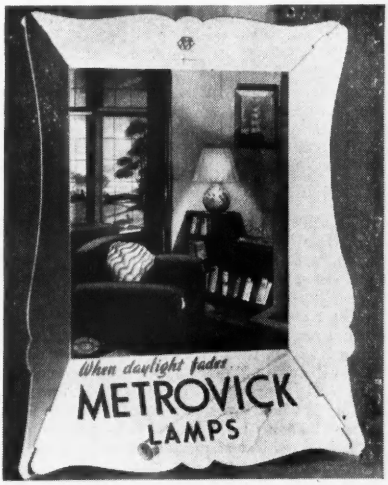
Lamp Publicity

New Season's Display Material

THE autumn lamp campaign of the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., includes a series of Press advertisements and window displays putting special emphasis on quality control in lamp manufacture. The familiar slogan "When daylight fades . . . Metrovick Lamps" is illustrated in a new framed showcard 24in high and printed in nine colours. New cartons, printed in the attractive orange and black standardized for Metrovick lamp publicity, are now in use for all general service lamps up to the 100 W size.

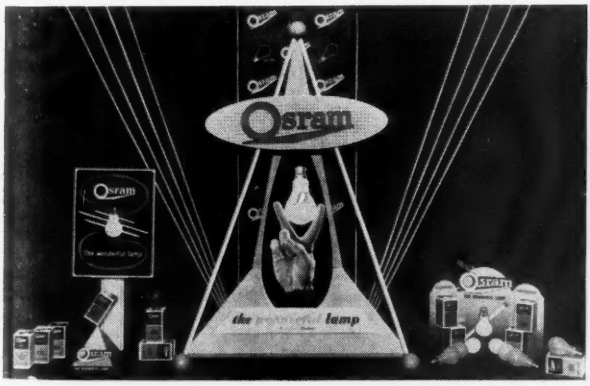
New editions of the lamp catalogue and the pin-up lamp price folder are ready for immediate issue. They have striking orange and black covers with a pattern of lamp outlines which readily identifies their contents. The pin-up folder is particularly useful for contractors' showrooms as on one side are boldly printed prices, with "at-a-glance" details of purchase tax, of all the lamps in common use. Motor car lamp prices are boldly displayed on the reverse side.

On 1st September an entirely new range of Metrovick fluorescent fittings will be introduced for 5ft 80 W and 4ft 40 W lamps; other lengths and sizes will be added to the range later. The main feature of this new range is a basic channel to which various types of interchangeable reflectors can be readily attached—or detached for cleaning—by "Oddie" clips. Details of this new range of fittings are given in a broadsheet specially designed for easy price reference by the contractor. New editions of a streetlighting catalogue and an industrial fittings catalogue are in preparation for the latter part of the year, and a brochure dealing with ship-lighting fittings will also be available shortly.



Metrovick showcard printed in nine colours

The new display material which the GENERAL ELECTRIC CO., LTD., has produced for dealers includes three cardboard cut-outs and a showcard, each presenting the slogan, "Osram the Wonderful Lamp," in a colourful and attractive form. The showcard design depicts an "Osram" lamp held in a hand raised in the "V" sign. The same theme is being used in many other forms of "Osram" publicity this season. A folding cardboard strut and hanging loop at the back of the card enable it to be stood on a counter or suspended.



A window display incorporating the new "Osram" centre-piece with the "V" sign theme

The theme is repeated in the new three-dimensional window display, where it is given prominence in front of a black oval screen. The slogan appears in red " Dayglo " fluorescent paint on a yellow shield. Three white wooden dowels, terminated by mauve spheres, form a pyramid-shape supporting framework for the display. The " V " sign design is used also in a new cardboard cut-out, in which the hand and lamp stand up in front of an oval black background to give a three-dimensional effect. Another cut-out introduced this season provides for displaying an actual lamp alongside a replica of an " Osram " carton. The third new cut-out forms a frame for a carton, and is surmounted by a decorative facia embodying the " Osram " slogan and two lamps in outline.

The " V " sign design on posters will link up with dealers' own window displays. In the Press there will be a new slogan, " Pick of the Bunch." The importance of the housewife as a customer is the theme of a broadsheet—" Who buys Lamps? "—which is being issued to dealers to inform them of the whole scope of this season's publicity effort. New literature includes a leaflet that explains the importance of the " Silverlight " lamp as a means of avoiding glare and consequent eyestrain. Fluorescent lighting is the subject of a new folder in colour.

Two leaflets have been prepared on the specialized subject of photographic lighting. A new edition of the " Osram " catalogue, with 60 pages illustrating lamps for every lighting purpose, is being issued. An abridged list giving details of the lines most generally used is also being published.

An intensive campaign in the trade, technical and general Press for " Mazda " lamps has been planned for the winter season by the BRITISH THOMSON-HOUSTON CO., LTD. A circular showcard, similar in design to the advertisement already appearing in buses, will be available to dealers. This is printed in five colours which form a spectrum background to the " Mazda "

A " Mazda " lamp counter showcard

name plate and slogan. A display centred around photoflash bulbs is also available for use in windows and on dealers' counters. Printed in seven colours with the same spectrum background, this has a platform on which the actual bulbs can be exhibited. The window dressing scheme for dealers' premises will continue to operate with attractive displays. Bulletin boards, some of them floodlit after dark, will be seen on selected sites along important main roads near London. Illuminated box signs for dealers' premises will also be available. Literature will include a pocket catalogue giving full details of " Mazda " lighting equipment, a new edition of the lamp catalogue (to be published later in the season), and loose leaf data sheets providing details of the operation and application of lamps and fittings. The quarterly magazine " The Outshining Light " will continue to give up-to-date details of developments in the manufacture and application of both lamps and lighting fittings.

Television Convention

THE planning of the Television Convention, which is being arranged by the Radio Section on behalf of the Council of the Institution of Electrical Engineers, is well advanced. The whole field of television will be covered in nine sessions, each of approximately two hours' duration, at which a survey paper and a number of supporting papers will be discussed. The titles of the sessions are: programme origination, point-to-point transmission, broadcasting stations, propagation, receiving equipment (two sessions), non-broadcasting applications and system aspects. There will also be a historical paper and a broad survey paper to act as an introduction to the whole Convention.

In addition to the technical sessions there will be a number of visits to industrial and other appropriate organizations. Meeting proofs of all papers will be available shortly before the Convention. Non-members and overseas visitors will be welcome and suitable notices are being circulated to sister institutions and engineering societies abroad. Non-members wishing to attend will be required to pay a registration fee.

The proceedings of the Convention, comprising the opening addresses, the full text of all the papers and reports of the discussions, will be published in four issues of Part IIIA of the *Proceedings* of the I.E.E.

Conditions in Pakistan

Industrial Progress Since Partition

THE industrial conditions created by the formation of the State of Pakistan in 1947, and the outlook for imports, are dealt with in a report on the economic and commercial conditions in Pakistan, prepared by Mr. W. Godfrey, formerly United Kingdom Senior Trade Commissioner in Pakistan, for the Commercial Relations and Exports Department, Board of Trade (H.M. Stationery Office, 5s net).

Referring to import trade, Mr. Godfrey says that Pakistan's plans for hydro-electric development imply considerable quantities of contractors' plant and will require heavy importations of generating equipment, and there are in addition, plans for the construction of more thermal power stations. Increased electrification should mean a demand for electrical plant and machinery and for appliances of all kinds.

Trade Prospects

United Kingdom trade with Pakistan has grown steadily from partition until the reimposition of import licensing in September, 1949, when this country's share of the total imports was 28·3 per cent, and whatever level of imports Pakistan may in future be able to permit, it is likely to remain large. United Kingdom manufacturers and exporters enjoy an advantage from the high reputation of their goods in the subcontinent, but competition is growing steadily. Higher prices and long delivery periods for the supply of United Kingdom goods, particularly machinery, have tended to encourage Pakistan buyers to turn to other sources of supply. United States competition in machinery and plant has been keen, while Germany and Japan have made headway with offers at prices considerably lower than United Kingdom prices. The establishment of local agents and representatives is increasingly necessary.

An appendix to the report shows the value of certain classes of electrical goods imported from the United Kingdom in 1949. Electric cables, wires, strips and strands, insulated other than rubber, except telegraph and telephone, were valued at £126,000, domestic radio receiving sets at £71,000, bulbs and discharge lamps complete at £33,000, and electrical machinery, except generators and motors and parts, at £183,000.

The report reviews the state of the main industries in Pakistan, and the plans for their development prepared by the Ministry of Industries. At the partition there were about twenty concerns producing diesel engines of from 10 to 40 h.p., but sales have dropped now that imported diesel engines are more freely available. The Government's development plan envisages the reorganization of the industry on a proper basis and the standardization of engines, with a view to improvement of quality. It is also planned to augment the present capacity by erecting four new factories to produce engines to the value of Rs. 40 lakhs per year, but at the date of the report (May, 1950), little progress had been made with this scheme.

Manufacture of Electrical Goods

Dealing with the manufacture of electrical goods, Mr. Godfrey states that there is one factory at present manufacturing electric lamps in Karachi. It went into production in 1948, and at first, was mainly engaged in the assembly of imported parts. The capacity of the factory is about 750,000 lamps of from 15 to 100 W a year. There is almost no industry making electrical appliances, but five concerns manufacture electric ceiling fans, with a total output of 5,000. It is proposed to expand this capacity by erecting ten new units to produce unspecified electrical goods to the value of Rs 1½ lakhs a year, although at the date of the report there were no concrete plans.

A good deal of information is given on schemes for developing the electric power supply of Pakistan. At the time of partition the generating capacity of the State was only 40 MW. At the first Industries Conference held in 1947 the target laid down to be reached in five years was 500 MW. Sir Henry Howard, in his

survey of the country's requirements, assessed the demand for power by 1955 at 199 MW, and on his recommendation the Central Engineering Authority was formed in July, 1948, to co-ordinate power development and the utilization of power and water resources.

As a first step in the improvement of power supply, the consulting engineers to the Government of Pakistan have surveyed the existing thermal stations and their rehabilitation requirements. They have also been asked to carry out an intensive survey preparatory to the drawing up of an all-Pakistan plan for electrical development, which would include a survey of fuel and hydro-electric resources, future load possibilities, a plan to meet temporarily the power shortage of the country, and a programme for the proposed expansion of electricity supply schemes. They estimate the present installed capacity of power stations in Pakistan at 69 MW, of which a total of 10·7 MW is hydro-electric. A plan to link up the whole of Western Pakistan and the whole of Eastern Pakistan in a grid system is being prepared. A central pool will be established and equipped with small diesel sets and other plant to prevent interruptions in supplies and to tide over failures or breakdowns. The plant in this pool will also help to fill the gap in power supplies before the new hydro-electric stations start up.

The estimate of water power resources of Pakistan places the potential at 5,000 to 6,000 MW and the report briefly reviews the various schemes of development. These include the Malakand, Dargal, Rasul, Mianwali, Karnafuli and Warsak Dam schemes, and a number of smaller projects. The most important of these are the Mianwali scheme which will have an ultimate installed capacity of 70 MW, and the Warsak Dam, which will have a station of 125 MW.

North Western Board Activities

THE Royal Lancashire Show, a major North-Western agricultural event, again proved a successful venue for the North Western Electricity Board. The Show was held this year from 1st to 4th August, at Witton Park, Blackburn. Inquiries at the Board's stand totalled more than at the two previous Royal Lancashire Shows. The main marquee housed, together with farming domestic appliances, a model dairy. One of the two annexes was devoted to farm building and farmyard equipment, while the other dealt with horticulture. A particular centre of attraction was a barn hay drying installation.

A decorated lorry specially planned by the North Western Board's publicity staff to participate in the Festival of Britain and similar celebrations throughout the North-West, has been in continuous service since its first procession in East Lancashire. The lorry carries an advertising display which incorporates an animated hand working a switch, and stressing the slogan "Electricity service lies in the switch —so does economy."

The Board's mobile service centre, commissioned in June, has been visiting rural communities in Lakeland without normal showroom services. This is the second showroom of its type to be taken into service by the Board. The first, introduced in March, has been operating in Lancashire. The body of the Lakeland showroom is constructed of extruded aluminium, and apart from the normal entry door it has special double doors to facilitate the handling of equipment. Kitchen units installed are in cream and eau de nil timber and plastic. The whole is lit by peach fluorescent tubes.

The North Western Electricity Board's stand at the Royal Lancashire Show

Irish Electrical Progress

Electricity Supply Board's Report for 1950-51

THE report of the Electricity Supply Board, Dublin, for the year ended 31st March last begins by saying that during the year there was an unprecedented growth in the demand for electricity and, under favourable water conditions, it was possible to take the load.

Because of the scarcity and high cost of other fuels there was a widespread change-over to electricity for heating. The unrestricted heating demand is tending to exceed the total industrial load raising difficulties which necessitate steps to limit the heating load and to transfer it gradually to night storage heating.

Water conditions were so favourable during the year that the output from the Shannon (Ardnacrusha) station reached its highest recorded figure—388 million kWh. The total output of the system was 969 million kWh, an increase of 24 per cent upon the preceding year's figure; of this hydro-electric stations were responsible for 466 million kWh and steam stations for 503 million. The average load was 110·6 MW and the annual load factor (on kWh generated) was 44·1 per cent.

To meet future demands heavy capital investment is being made in the installation of new generating plant and 270 MW will be put into service in the next few years; the present capacity is 263 MW.

Serious delays are being experienced in the commissioning of new stations because of the failure of manufacturers to adhere to delivery dates and shortages of materials. These delays, coupled with the rising demand, make the maintenance of supply very difficult.

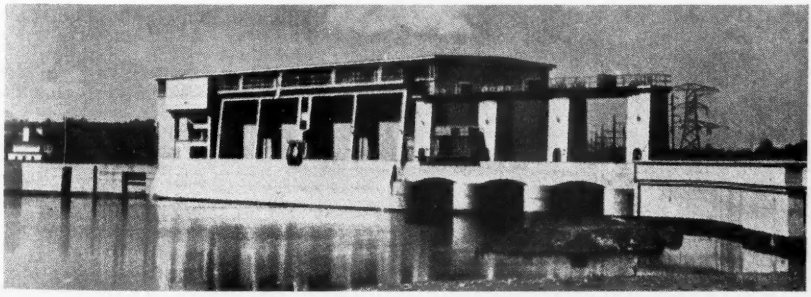
The number of consumers rose from 310,639 to 343,376, the total sales from 626 to 770 million kWh and the gross revenue from the sale of electricity from £4,773,725 to £5,584,333; the average price per kWh sold fell from 1·83d to 1·74d.

The total gross revenue was £5,615,769 (against £4,818,477) and working expenditure £3,862,706 (£3,458,207) and after meeting interest and repayment of advances the surplus was £514,107 (£239,344). To this were added profits on sale of appliances (£27,324 on a turnover of £381,821) and on consumers' installations (£5,420 on work invoiced at £279,163). The allocations include £200,000 to income tax reserve and £400,000 to contingencies reserve (making £800,000).

The Board says that its estimates for the current year show such increased production costs, because of higher wages and salaries and the high cost of coal which has to be imported from America, that a substantial deficit must be anticipated which can only be met by price increases.

Plant put into commission during the

The new hydro-electric station at Cliff on the River Erne



year represented a capital investment of £4,881,573, raising the aggregate at 31st March last to £38,939,061.

Details are given of the newly-commissioned plant. At the North Wall (Dublin) oil-fired station, which has one 12·5 MW set, the fourth boiler unit was put into service. The Portarlington (Co. Leix) turf-fired station was completed by the installation of the second 12·5 MW set and third boiler.

On the River Erne the Cliff station (illustrated) was put into operation with one 10 MW set with associated transformers and switchgear. This station is designed to take a second, similar, set. The Cathaleen's Falls station, in which two 22·5 MW hydro-electric generators are to be installed, was well advanced; it is expected that the first set will be available for service before the end of this year and the second early in 1952.

Another set which is expected to be ready by the end of the year is the first of the two 20 MW sets at the Allenwood (Co. Kildare) turf-fired station. The two 30 MW sets at the Ringsend (Dublin) coal- or oil-fired station may be ready for service in 1954.

Work on the site of the River Lee (Co. Cork) development is to commence during the coming year. There are to be two stations, Inishcarra and Carrigadrohid, and it is expected that the first will be completed by 1955. Preliminary work is in progress on the Cork coal- or oil-fired station; the first 30 MW set is being manufactured and orders for the second, similar, set have been placed. Design work is in hand for the Ferbane (Co. Offaly) turf-fired station which will have two 20 MW sets.

Particulars are given of the extension of the 110 kV, 38 kV and 10 kV transmission systems, and of work done on the l.v. distribution systems.

Despite a slowing-down of the rate of construction, through shortages of materials and technical staff, more rural electrification work was carried out during the year than in 1949–50; 42,423 poles were erected, 2,232 miles of line were strung, 15,803 consumers connected and 49 areas completed. At March 31st last there were 131 completed areas with 40,956 consumers. Revenue from rural consumers gives a very low return on the investment and the Board considers that the Government's 50 per cent subsidy is inadequate.

The report contains details of water storage and river control during the year and water power resources survey work and a report on the Shannon Fisheries is included.

Appendices give detailed figures for the various districts, generation and load curves, and other information on various phases of the Board's work.

"Model Engineer" Exhibition

A CHURCHILL tank 4ft long which obeys sixteen different orders under radio control, including working the turret, firing the gun and laying a smoke screen, is an outstanding exhibit at the "Model Engineer" Exhibition which until to-morrow (1st September) is being held at the New Horticultural Hall, Westminster. Other radio controlled items include a 70in long model of the *Queen Elizabeth* and a motor yacht.

Among the engineering models are a steam driven generating set, 36in long by 9in wide, which will light six lamps, and a wind-driven generator on a lattice tower with an output of 15 W. A working model cinema, 4ft by 3ft by 3ft, gives demonstrations during the evenings. With its dimmer controlled four-colour lighting, motor-operated curtains, push-button controlled, seventy-four stage lights, nine house lights, a chandelier containing 800 beads, a fountain and a waterfall of "Perspex" for the stage set, and films projected from the back, the effect is most lifelike.

Several models relating to the submarine cable industry have been lent by the Telegraph Construction & Maintenance Co., Ltd. One of them, over a hundred years old, is of the *Great Eastern* cable ship, which laid the first Atlantic cables made by the company. Specimens of the first Atlantic cable are also shown, together with a model of the cable ship *Colonia* (1902–1928), which laid over 80,000 nautical miles of submarine cable.

Batteries for all purposes form the theme of a display by Chloride Batteries, Ltd., other trade exhibits including electric tools (Black & Decker, Ltd.), wood engraving tools and soldering irons (Acru Electric Tool Manufacturing Co., Ltd.), forge blowers (Wm. Allday & Co., Ltd.), portable welders (Donald Ross & Partners, Ltd.), radio control units (Electronic Developments (Surrey), Ltd.) and miniature electric motors (Victory Industries (Surrey), Ltd.). Plans and components for constructing a refrigerator are shown by Brade Bros.

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

Johnson, Matthey & Co., Ltd., have announced that the publication of the White Paper on the Control of Dividends has made it necessary for the directors to reconsider the arrangements for the issue of 737,776 £1 ordinary shares. In the circular letter to shareholders of 14th July, it was stated that the directors considered that they should be in a position to recommend for the year ending 31st March, 1952, a total dividend of 15 per cent on the increased ordinary share capital. It appears, however, that if the proposals in the White Paper became law the company will be unable to pay dividends on the increased capital at a rate in excess of 13½ per cent, in respect at least of each of the three years ending 31st March, 1954. It is now proposed to offer the 737,776 ordinary shares for subscription at 54s per share (instead of at 58s as originally proposed) to the holders of ordinary shares and loan stock in the proportion of one new ordinary share for every ordinary share and for each £3 12s of loan stock held respectively. The new ordinary shares will entitle the holders to participate to the extent of one-half only in any dividends which may be declared in respect of the year ending 31st March, 1952, and will in all other respects rank *pari passu* with the existing ordinary shares.

The Phœnix Telephone & Electric Holdings, Ltd., proposes to pay an ordinary dividend of 10 per cent. The company was incorporated on 4th December, 1950, and the accounts were closed for the initial period on 28th February last. A full year's dividend has been received from the main operating company. The profits of the subsidiary companies for the year ended 28th February last, after deducting all charges, including taxation, is £38,678, and after writing off goodwill and preliminary expenses of subsidiaries, and £18,664 retained and carried forward in the operating subsidiaries' accounts, the amount transferred to the holding company is £9,833. The balance carried forward is £487.

Associated Electrical Industries, Ltd., announces that the offer, which closed on 21st August, of 330,760 4½ per cent "B" cumulative preference shares of £1 each to existing preference shareholders was fully subscribed. Applications up to 10,000 shares will be allotted in full. Larger applications will be scaled down.

Belliss & Morcom, Ltd., report a consolidated trading profit for the year ended 31st March last of £143,627, as compared with £157,837 for the preceding year, to which is added £32,005 income from investments. After deducting depreciation, etc., amounting to £45,840 and taxation of £76,956, the net profit is £52,836 (against £54,807). It is proposed to pay a final dividend of 8½ per cent, maintaining the distribution for the year at 12½ per cent. The balance carried forward is £30,566 (against £25,441 brought in).

The Nigerian Electricity Supply Corporation, Ltd., states that in 1948 it was estimated that the construction of the Jekko II power station would cost £175,000, but the general rise in prices has made it necessary to increase the estimate to £253,000. It is proposed to meet part of the additional cost by an issue in due course of not more than 49,600 ordinary £1 shares at par to shareholders in proportion to their holdings.

The Automatic Telephone & Electric Co., Ltd., has declared an interim dividend on the ordinary stock of 3 per cent actual, less tax (unchanged).

The Rheostatic Co., Ltd., is paying an interim dividend of 4 per cent, the same as last year.

New Companies

Hadley Bros. (Radio & Electric), Ltd.—Registered 31st July. Capital £15,000. Directors: N. C. Hadley, Una Hadley, V. J. Hadley and Kathleen M. Hadley. Regd. office: 587-9, Bearwood Road, Smethwick, Staffs.

Clock Rentals, Ltd.—Registered 4th August. Capital £100. Electrical contractors, electrical, mechanical, telephonic, wireless and general engineers, manufacturers of and dealers in electric clocks, etc. Directors: W. S. Finlayson and A. Ellison. Regd. office: 65, Erskine Street, Liverpool, 6.

H. S. Bloom & Son, Ltd.—Registered 8th August. Capital £1,000. To acquire the business of electrical contractors which is now carried on by H. S. Bloom and C. A. Bloom at 1, Senghenydd Road, Cardiff as H. S. Bloom &

Son. Directors : C. A. Bloom and W. Lewis. Regd. office : 1, Senghenydd Road, Cathays, Cardiff.

W. H. Garrod (Electrical), Ltd.—Registered 9th August. Capital £500. Electrical, radio, television and mechanical engineers and contractors, etc. Directors : W. H. Garrod and K. C. Lynn. Regd. office : 134, Alexandra Road, Wimbledon, S.W.19.

S. Charlesworth & Co., Ltd.—Registered 13th August. Capital £10,000. To acquire the business of S. Charlesworth & Co., carried on by P. Skipworth at Oldham and to carry on the business of electrical engineers, manufacturers of and dealers in electrical and mechanical apparatus, etc. Directors : P. Skipworth, Mrs. Amy Skipworth, Miss Lily Skipworth and R. Skipworth. Regd. office : 6, Clegg Street, Oldham.

Transformers & Rectifiers, Ltd.—Registered 11th August. Capital £1,000. Manufacturers of and dealers in dynamos, motors, armatures, transformers, rectifiers, etc. Directors : F. T. Cowley and Mrs. Sophia D. Cowley. Regd. office : Bury Fields Lane, Millmead, Guildford, Surrey.

L.G.A. (Sales), Ltd.—Registered 11th August. Capital £1,000. Manufacturers and repairers of and dealers in lighting and power equipment, generators, dynamos, etc. Directors : Sir Oliver H. Dyke, Bt., L. A. Glazier and P. S. Boyle. Regd. office : Commerce House, 6-8, Blagrave Street, Reading.

Northern Wholesale Electrical Distributors, Ltd.—Registered 22nd August. Capital £2,000. Directors : D. B. Sonley, G. F. Fenwick and T. Fenwick (secretary), all directors of Tates Radio Co., Ltd. Regd. office : 66, John Street, Sunderland.

Central Electric Co. (Liverpool), Ltd.—Registered 17th August. Capital £2,000. Wireless, television, telephone and telegraphic engineers, electrical engineers, etc. R. J. Keeley is the first director. Regd. office : 33, The Temple, " C " Building, Dale Street, Liverpool.

Increases of Capital

E.M.B. Co., Ltd. (formerly Electro-Mechanical Brake Co., Ltd.).—Increased by £100,000, in £1 shares, beyond the registered capital of £100,000.

Associated Electrical Industries, Ltd.—Increased by £1,303,950, in 1,000,000 ordinary and 303,950 4½ per cent " B " preference shares of £1 each, beyond the registered capital of £8,696,050.

Wandleside Cable Works, Ltd.—Increased by £40,000, in £1 ordinary shares, beyond the registered capital of £35,000.

Meeting of Creditors

P. A. Robinson (Electrical) Co., Ltd.—Meeting of creditors 11th September at the offices of Saunders, Sobell, Greenbury, Leigh, 194-200, Bishopsgate, London, E.C.2, for the purposes mentioned in Sections 294 and 295 of the Companies Act, 1948.

Liquidations

Elkrom Electrical Development, Ltd.—Winding up voluntarily. Liquidator, Mr. H. W. Bonnello, Milton Chambers, Milton Street, Nottingham, appointed 15th August.

Gilbert Graham & Co., Ltd.—Liquidator, Mr. F. C. Ormrod, Official Receiver's Office, 20, Byrom Street, Manchester, 3, released 17th July.

Bankruptcies

W. L. Lackie, 38, High Street, Pwllheli, Caernarvonshire, radio dealer.—Trustee, Mr. P. S. Booth, 5, Rumford Place, Chapel Street, Liverpool, 3, released 23rd July.

Hannah R. Aarons, lately carrying on business as " Radco Co. (Wholesalers) " at 764, Lea Bridge Road and 35, Tallack Road, London, E.17, electrical wholesaler.—First and final dividend of 2s in the £, payable on or after 17th September at 76, New Cavendish Street, London, W.1.

R. T. H. Brimfield, carrying on business as " Richfield Electrical Components, " 73-78, High Holborn, London, W.C.1, electrical contractor.—Fifth and final dividend of 9 3/16d in the £, payable on or after 14th September at Bankruptcy Buildings, Carey Street, London, W.C.2.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 22nd September.

FERROSONIC. No. B698,029. Class 9. Sound records and sound recording apparatus.—Kirdon Electric, Ltd., Factory Yard, The Broadway, Hanwell, London, W.7.

No. 698,282 (design). Class 9. Scientific, nautical, surveying, photographic, optical, weighing and measuring apparatus and instruments, electrical apparatus and instruments included in Class 9 and calculating machines, and parts included in Class 9 of all the aforesaid goods.—Dring & Fage, Ltd., 150-152, Tooley Street, London, S.E.1.

TELEREL. No. 699,321. Class 9. Apparatus for recording and reproducing telephone messages.—Ateliers de Constructions Electriques de Charleroi, Brussels, Belgium. Address for service, c/o Feeny & Feeny, 2a, Charlwood Place, Westminster, London, S.W.1.

PERTRIX. No. 699,343. Class 9. Electric accumulators and electric torch cases. PERTRIX. No. 699,344. Class 11. Electric torches.—Holsun Batteries, Ltd., 137, Victoria Street, London, S.W.1.

SUPERLYTIC. No. 699,743. Class 9. Capacitors (electrical condensers).—Telegraph Condenser Co., Ltd., Wales Farm Road, North Acton, London, W.3.

STOCKS and SHARES

FOREIGN politics and the holiday season continue to join forces in bringing about a condition of Stock Exchange business which inevitably recalls "a painted ship upon a painted ocean." In the circumstances, it is surprising that quotations hold their ground as well as they do, considering the modest amount of public support that there is for meeting the ordinary business of sales on behalf of deceased accounts and similar realizations. The dividend restriction policy constantly crops up as an impediment to enterprise and business.

Radio and Television

The opening of the Radio and Television Exhibition usually serves to draw attention to shares of the companies concerned in the industry, and a certain amount of inquiry has come into the market for information as to what the ordinary shares pay, from the point of view of investment. Taking a few examples, E. K. Cole shares at 21s return £5 7s 6d per cent; Cossor ordinary do not yet receive a dividend, though it is hoped that in the near future the company will re-enter the dividend list. Decca 1s shares at 18s 6d, on the 112½ per cent distributed for some years, pay £6 1s 0d per cent. Ever Ready at 31s give £5 13s 0d per cent. Pye deferred offer a little over 4 per cent, Thorn Electric and Plessey, 5¼ per cent, and E.M.I. 4¼ per cent. These yields are calculated upon the estimated dividends that the companies may be expected to pay if the dividend restriction proposals become law.

Lancashire Dynamo

Lancashire Dynamo Holdings, Ltd., has called a meeting for 11th September in order to pass the necessary resolutions for increasing the capital of the company. A little over three months ago, the company obtained Treasury consent for a 100 per cent scrip bonus, which would capitalize £584,332 from the share premium account. The price of the shares has been noticeably good for some little while and, although it fell to £5 after the Gaitskell bombshell, it recovered to 5⅜. The company has paid 22½ per cent dividends in each of the past nine years. A year ago, 83,476 ordinary shares were issued at £4 per share to ordinary stockholders in the proportion of one new for six old. Lancashire Dynamo are regarded as being amongst the "blue chips" in the industrial market, to which the modesty of the 4¼ per cent yield, on a 22½ per cent dividend, bears witness.

Metal Industries

Metal Industries, Ltd., is another company which recently made a new issue to the existing holders of its ordinary shares. Last March, one new share for every four old shares was offered at 32s 6d. The new shares rank *pari passu* with the existing ordinary shares, and for the full amount of final dividend for the year to 31st March last. This final dividend is repeated at 7 per cent, making 10 per cent for the year, and the latter is taken as being the standard which the company will be allowed to pay under dividend control. Thanks to the new issue, the bank overdraft was reduced to £255,000, and Metal Industries was able to take up 180,000 shares in British Oxygen at a cost of £630,000. The present price, 44s, shows a return of 4½ per cent on the money, and is about 6s below the best quotation touched this year. In 1947, by the way, Metal Industries rose at one time to £3 10s 0d.

Price Fluctuations

The movements in prices during the past week have been fairly well balanced between rises and falls. Amongst the latter, Greenwood & Batley, 52s, are 1s 3d down. Falls of 1s each lowered Decca to 18s 6d and Associated Electrical Industries to 86s 6d. British Electric Traction deferred at 495 is 10 points lower. The rises include Lucas 38s 9d, Crabtree 41s 3d, London Electric Wire, 48s 3d, Automatic Telephone 72s, Siemens 43s. Baldwin and Oldham, at 6s and 5s 3d respectively, are both a few pence better.

Telephone Properties

Interest has been aroused by the consistent rise, for some weeks past, in the ordinary shares of Telephone Properties, Ltd., the company which started life as the Venezuela Telephone & Electrical Co.; Sir Alexander Roger is the chairman. Two years ago, the shares were standing for some time at 8s 6d. To-day's 31s 3d is the highest reached for more than ten years. Following an annual 6 per cent dividend for six years, the distribution was raised to 7 per cent in 1949 and to 8 per cent for 1950. This gives an average of 7½ per cent for the last two years, and at 31s 3d the yield would be £4 16s 9d per cent on the money.

The chairman has stated that the greater part of the improved results for 1950 was attributable to the favourable effect of the rate of exchange. For years past, one drawback to investment in the shares was the geographical position of the company. This clearly is no objection to the recent buyers of the shares. Their persistent support has led to vague surmise as to whether some sort of bid may be made for the company. This is the merest conjecture, but holders of the shares are probably wondering whether there is anything which might account for the rise.

ELECTRICITY SUPPLY

Power Station Consents

Effect of Capital Restrictions in Yorkshire

THE British Electricity Authority has received the consent of the Minister of Fuel and Power to the establishment of the proposed new power station at Marchwood, near Southampton, and to the extension of the Goldington power station at Bedford. The Marchwood station, which will stand on a site of approximately 140 acres, will have a capacity of 480 MW, comprising eight 60 MW turbo-alternators and eight 550,000 lb/hr boilers. The extension of the Goldington station comprises four 30 MW turbo-alternator sets, four 300,000 lb/hr boiler units and three cooling towers. The first two turbo-alternator sets and associated boilers have already been authorized.

Yorkshire Development Delayed

Local authorities in its area have been informed by the Yorkshire Electricity Board that it will temporarily be unable to provide electricity to premises which already have a gas supply if there is no convenient electricity main available. It is explained that the decision has had to be made because of the Treasury restrictions on capital expenditure. A warning has been given to electrical contractors to make sure that a supply will be available before they carry out new installation work.

A Long Wait

The *South Yorkshire Times* recently mentioned that 112 houses at Treeton, in the Rotherham Rural District, wired for electricity seventeen years ago are still unconnected and, according to Mr. A. Haddock, the Sub-Area manager of the Yorkshire Electricity Board, are unlikely to be served for some time yet.

Douglas Electricity Report

The output of the Douglas (I.O.M.) electricity undertaking fell by 8,729,590 kWh to 23,719,915 kWh in 1950–51 due to the loss of the bulk supply to the Isle of Man Electricity Board for the major portion of the year. In his annual report, Mr. C. Anderson, the borough electrical engineer and manager, states that 16,547,504 kWh was sold, an increase of 15·54 per cent. The maximum load was 8,734 kW. Although the revenue increased by £17,179, owing to the loss of the bulk supply to the I.O.M. Electricity Board, a deficit of £12,186 is shown for the year. The Board's contribution to the cost of operation, maintenance and interest and sinking fund charges amounted to over £20,000 in 1949–50. With the cessation of the supply to the Board, the whole of these charges are now borne by the Corporation's undertaking, resulting in a considerable increase in the cost of production. The Corporation has taken steps, with the consent of Tynwald Court, which it is hoped will ensure that the present tariffs can be maintained. The average cost of fuel delivered to the power station has risen from £3 5s 3d to £3 7s 5d per ton. Progress on the installation of a 5,000 kW turbo-generator and two 60,000 lb/hr boilers has been slow owing to delays in the delivery of the building steelwork. During the year a further 1,273 consumers were changed over from d.c. to a.c. The number of consumers connected rose from 7,797 to 8,314.

Load Spreading Discussions

To achieve a saving of 20 per cent during peak hours, the Bradford, Keighley and District Electricity Committee made a recommendation on 22nd August that industrial users should work a five group rota scheme with hours on four days of 7 a.m. to noon and 1 p.m. to 5.30 p.m. and on the fifth day from 12 noon to 4 p.m. and 5 to 8 p.m. At a meeting last week representatives of Bradford and district worsted spinners, manufacturers and the textile trade unions took the view that this recommendation to work a late evening shift would be unacceptable, as the textile mills employed a large proportion of women who would not want to work in the evenings. The meeting was only a preliminary one and it now rests with the representatives to suggest a scheme whereby the objections to evening work would be overcome.

North Eastern Payments Scheme

The North Eastern Electricity Board has completed plans for instituting a system of weekly or monthly payments of electricity bills for consumers who find difficulty in meeting quarterly accounts. According to the number of rooms payments will vary from 1s to 1s 11d weekly or 4s to 7s 8d monthly, including a charge of 2d for collection. At the end of each year, each consumer's payments will be added up and if they amount to more than his actual consumption of electricity he will receive a refund. If they are less the consumer will pay the excess due.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s each) will be obtainable after 10th October from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1947

11125. Igranic Electric Co., Ltd.—Low-frequency generator. 25th April, 1947. (658732.)

12489. General Electric Co., Ltd., Levy, M. M., and Edwards, G. W.—Monitoring of multi-channel pulse signalling systems. 23rd April, 1948. (658734.)

13687. Radio Corporation of America.—Cathode-ray pick-up tubes. 21st May, 1947. (658735.)

16877. Sperry Products, Inc.—Supersonic inspection 26th June, 1947. (658737.)

19777. British Thomson-Houston Co., Ltd.—Polymerization. 23rd July, 1947. (658741.)

21665. Marconi's Wireless Telegraph Co., Ltd.—Ultra-short wave radio antennæ. 7th August, 1947. (658612.)

27411. Igranic Electric Co., Ltd.—Temperature-responsive control devices. 13th October, 1947. (658744.)

28262. Western Electric, Inc.—Radar systems. 22nd October, 1947. (658745.)

29606. Igranic Electric Co., Ltd.—Control for alternating current motors. 6th November, 1947. (658746.)

30471. British Thomson-Houston Co., Ltd.—Electric discharge devices. 17th November, 1947. (658747.)

32333. General Electric Co., Ltd., McKeag, A. H., and Ranby, P. W.—Luminescent materials. 9th December, 1948. (658748.)

34837. Staatsbedrijf der Posterijen Telegrafie en Telefonie.—Automatic telegraph exchange systems. 30th December, 1947. (658514.)

35377. British Thomson-Houston Co., Ltd.—Electrical circuits for use with discharge devices. 31st December, 1947. (658750.)

1948

13234. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Frequency-divider circuit arrangements. 14th May, 1948. (658518.)

18557. Soc. d'Inventions Aeronautiques et Mécaniques, S.I.A.M.—Electric motor-driven, valve-regulating apparatus. 9th July, 1948. (658,620.)

18884. Ross, S. B.—Telephone supports. 14th July, 1948. (658753.)

20022. British Thomson-Houston Co., Ltd. (General Electric Co.).—Electronic mixer circuits for arithmetically combining two signals. 27th July, 1948. (658523.)

20689. Patelhold Patentverwertungs- & Elektro-Holding Akt.-Ges.—Arrangement for transmitting signals for automatically controlling the deviations of flying bodies from a prescribed path. 5th August, 1948. (658759.)

21102. Leich Electric Co.—Impulse-responsive stepping device actuated by magnetic torque. 10th August, 1948. (658622.)

21287. Philips Electrical, Ltd.—Circuits for producing sawtooth oscillations. 12th August, 1948. (658762.)

21707. British Thomson-Houston Co., Ltd., and Payne, K. J.—Control of electric power systems comprising a plurality of parallel connected generators. 9th September, 1949. (658624.)

22405. M-O Valve Co., Ltd., and Clack, B. N.—T.R. switches. 14 July, 1949. (658764.)

22407. General Electric Co., Ltd., and Clack, B. N.—Electric discharge lamps or lightning arrestors. 14th July, 1949. (658765.)

23826. Illinois Institute of Technology, Armour Research Foundation of.—Methods of focusing a diverging polychromatic beam of X-rays and an apparatus for X-ray analysis. 10th September, 1948. (658527.

25163. Sperry Corporation.—Directional antenna systems for electromagnetic wave-energy. 27th September, 1948. (658769.)

26074. Radio Corporation of America.—Gain control for amplifier systems. 6th October, 1948. (658770.)

26565. Neate, R. W. J., and Chandler, F.—Apparatus for applying tension to cables. 12th October, 1949. (658772.)

28183. Standard Telephones & Cables, Ltd.—Electron lenses for use in vacuum tubes. 29th October, 1948. (658779.)

29449. Standard Telephones & Cables, Ltd.—Switching system for establishing a plurality of connections by means of one or more switches comprising co-ordinate magnets. 12th November, 1948. (658784.)

32454. British Thomson-Houston Co., Ltd., Taylor, H. B., and Watts, A. J.—Wave guide to coaxial line transformers. 15th December, 1948. (658797.)

33034. Westinghouse Electric International Co.—Electric discharge lamps. 22nd December, 1948. (658799.)

1949

161. Whipp & Bourne, Ltd., and Whipp, I. T. L.—Electric circuit-breakers having arcing contacts. 4th January, 1949. (658633.)

425. Bendix Aviation Corporation.—Variable inductor. 6th January, 1949. (658637.)

657. British Thomson-Houston Co., Ltd.—Methods of preparing compositions containing methyl-substituted polysiloxanes. 10th January, 1949. (658640.)

1389. Murphy Radio, Ltd., Medway, S. A., and Elms, G.—Inductance coils of variable inductance. 8th December, 1949. (658652.)

1858. J. Lucas, Ltd.—Filling devices for electric storage batteries. 4th January, 1950. (658660.)

2027. Westinghouse Electric International Co.—Electric discharge lamps and holders therefor. 25th January, 1949. (658663.)

2552. Nield, D.—Electric insulators. 31st January, 1950. (658667.)

3137. Standard Telephones & Cables, Ltd.—Diversity reception employing frequency shift keying. 4th February, 1949. (658668.)

3830. Radio Corporation of America.—Multi-channel radio monitoring receiver. 11th February, 1949. (658671.)

4436. E. K. Cole, Ltd., and Knipe, A. R.—Device for extracting miniature radio valves from their sockets. 16th February, 1950. (658677.)

5355. Mather & Platt, Ltd., and McClenan, F.—Electrically-operated rolling shutters. 23rd February, 1950. (658681.)

6336. Soc. Independante de Télégraphie sans Fil.—High-frequency valve transmitters modulated by anode control. 8th March, 1949. (658684.)

6389. Clegg, C.—Electric heating of wash boilers and the like. 3rd March, 1950. (658685.)

6585. British Thomson-Houston Co., Ltd., and Maton, R. W.—Calibration of radar equipments. 10th March, 1949. (658686.)

7012. Office National d'Etudes et de Recherches Aeronautiques.—Ultra-high-frequency magnetometer. 15th March, 1949. (658341.)

7228. Metropolitan-Vickers Electrical Co., Ltd.—Manufacture of electrical coil assemblies. 16th March, 1949. (658688.)

8023. Ekman, O. I. H.—Electric cut-out or fuse for fire alarm purposes. 24th March, 1949. (658549.)

8119. Metropolitan-Vickers Electrical Co., Ltd., Ross, T. W., and Ryder, C.—Mounting of electric relays. 24th February, 1950. (658342.)

8120. Metropolitan-Vickers Electrical Co., Ltd.—Demodulators for frequency modulated signals. 24th March, 1949. (658554.)

8538. Sangamo Weston, Ltd., and McBride, M. G.—Electrical measuring instruments. 30th November, 1949. (658819.)

8775. British Thomson-Houston Co., Ltd.—Electric lamp bases. 31st March, 1949. (658347.)

8983. British Broadcasting Corporation, Minns, R. H., Thurnell, D. P., and Ashdown, S. J.—High-frequency electric transformers. 29th March, 1950. (658348.)

9395. British Thomson-Houston Co., Ltd.—Magnetic amplifiers for inductive loads. 6th April, 1949. (658564.)

9610. Allen West & Co., Ltd., and Potter, W.—Electro-magnetic switches. 28th March, 1950. (658696.)

9912. New Day Electrical Accessories, Ltd., and Davey, L. E. W. C. N.—Junction, switch and terminal boxes for electric wiring systems. 12th August, 1949. (658821.)

10021. Westinghouse Electric International Co.—Combustion apparatus. 13th April, 1949. (658697.)

11210. British Thomson-Houston Co., Ltd.—Magnetic cores. 27th April, 1949. (658355.)

11400. Brooke, W., and Baldwin, H. T.—Earth leakage protection systems for electric motors, cables and other apparatus. 29th April, 1949. (658823.)

11669. Automatic Electric Laboratories, Inc.—Relay. 2nd May, 1949. (658703.)

11944. Flight, T. N., Wilson, W. H., and Chinn, A. J.—Electric thermostats. 4th May, 1949. (658705.)

12062. British Thomson-Houston Co., Ltd.—Duplex directive antenna systems. 5th May, 1949. (658706.)

13138. British Thomson-Houston Co., Ltd.—Refrigerators. 17th May, 1949. (658359.)

13855. Eldorado Mining & Refining (1944), Ltd.—Apparatus for sorting radio-active ore. 24th May, 1949. (658572.)

14200. Liverpool Electric Cable Co., Ltd., Cox, J. R., and Frost, J. T.—Flexible electric cables or cords. 27th May, 1949. (658709.)

14556. Allmanna Svenska Elektriska Aktiebolaget.—Voltage regulating system for alternating current machines. 31st May, 1949. (658576.)

14729. British Thomson-Houston Co., Ltd.—Electric heating units. 1st June, 1949. (658711.)

14937. Westinghouse Electric International Co.—Door-operating mechanisms. 3rd June, 1949. (658712.)

14997. International Combustion, Ltd., and Wray, J. W.—Furnaces. 3rd June, 1949. (658713.)

15125. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Thermo-electric elements for measuring temperatures. 7th June, 1949. (658580.)

15198. Wallauschek, R.—Impedance transformers having high, adjustable, transformation ratios, suitable for use over a wide band in the hyperfrequency range. 7th June, 1949. (658581.)

16099. Stevens, J. H.—Illuminated indicators for electric switches or thermostats having rotary operating or adjusting knobs. 16th June, 1949. (658829.)

17977. F. A. Hughes & Co., Ltd., and Higgins, W. F.—Anodes for cathodic protection of metal structures. 27th February, 1950. (658364.)

18104. British Tabulating Machine Co., Ltd.—Pluggable units for mounting valves and circuit components. 8th July, 1949. (658365.)

19355. British Thomson-Houston Co., Ltd.—Filament support wire forming apparatus. 22nd July, 1949. (658368.)

20307. Igranic Electric Co., Ltd.—Method of and means for severing and sealing metal tubes. 4th August, 1949. (658598.)

20375. National Cash Register Co.—Electronic impulse counting circuits. 5th August, 1949. (658370.)

20554. Allmanna Svenska Elektriska Aktiebolaget.—Air-blast electric circuit breakers. 8th August, 1949. (658600.)

20622. Metropolitan-Vickers Electrical Co., Ltd.—Operating mechanisms for quick make-and-break electric switches. 8th August, 1949. (658602.)

20717. British Thomson-Houston Co., Ltd., and Wellings, J. G.—Noise reduction in electrical transformers and reactors. 9th August, 1949. (658603.)

20837. British Thomson-Houston Co., Ltd.—Bearing mountings. 10th August, 1949. (658373.)

21438. Landis & Gyr Soc. Anon.—Signalling apparatus for a maximum demand meter. 17th August, 1949. (658375.)

21688. Bonelle, G. J.—Electronic switching arrangements. 20th August, 1949. (658730.)

22290. Erie Resistor Corporation.—Condensers. 26th August, 1949. (658452.)

22537. Compagnie Industrielle des Piles Electriques C.I.P.E.L.—Primary batteries. 30th August, 1949. (658361.)

23609. British Thomson-Houston Co., Ltd.—Switching systems employing suitable reactors. 13th September, 1949. (658381.)

23636. American Smelting & Refining Co.—Process for the electrode position of zinc. 13th September, 1949. (658459.)

24042. British Thomson-Houston Co., Ltd.—Means for adjusting shaft end play. 19th September, 1949. (658830.)

24265. British Thomson-Houston Co., Ltd.—Electric switches for controlling the temperature of heating pads, blankets and the like. 21st September, 1949. (658383.)

24277. Aladdin Industries, Inc.—Table and like electric lamps. 21st September, 1949. (658384.)

24429. R. Bosch Ges.—Method for the manufacture of separator plates for electric storage batteries. 23rd September, 1949. (658386.)

24653. British Thomson-Houston Co., Ltd.—Toasters. 26th September, 1949. (658388.)

25951. Igranic Electric Co., Ltd.—Electrical switch contacts. 10th October, 1949. (658470.)

25989. Maschinenfabrik Oerlikon.—Dust separators. 10th October, 1949. (658471.)

26598. British Thomson-Houston Co., Ltd.—Rheostats. 17th October, 1949. (658395.)

27272. British Thomson-Houston Co., Ltd., and Sims, W. J.—Terminal housings for electric kettles and the like. 24th October, 1949. (658397.)

27398. British Thomson-Houston Co., Ltd.—Material drying apparatus. 25th October, 1949. (658398.)

27692. Philips Electrical, Ltd.—Electrolytic wound condensers. 28th October, 1949. (658399.)

28602. British Thomson-Houston Co., Ltd.—Electrolytic processing masks. 8th November, 1949. (658485.)

29209. Persson, F. R.—Electric safety lamp. 15th November, 1949. (658487.)

30137. H. W. Kearns & Co., Ltd., and Kearns, Sir H. W. L.—Control of electrically-effected adjustments of horizontal boring machines. 24th November, 1949. (658492.)

30250. Philips Electrical, Ltd.—Method of securing supply conductors to resistances constituted by semi-conductive material. 25th November, 1949. (658400.)

30604. British Thomson-Houston Co., Ltd.—Thermal responsive resistance devices. 29th November, 1949. (658495.)

30740. British Thomson-Houston Co., Ltd.—Electric toasters. 30th November, 1949. (658496.)

31176. British Thomson-Houston Co., Ltd.—Methods of making a joint in wound core. 5th December, 1949. (658401.)

31300. British Thomson-Houston Co., Ltd.—Lead-base solders. 6th December, 1949. (658402.)

31686. Westinghouse Brake & Signal Co., Ltd.—Photo-electric cells. 9th December, 1949. (658503.)

32243. Martin, C.—Apparatus for the modulation and keying of radio transmitters. 15th December, 1949. (658404.)

33100. British Thomson-Houston Co., Ltd.—Bearings. 28th December, 1949. (658405.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section, the date of the issue is given in parentheses.

Aspull.—1st September. U.D.C. Electrical wiring of 9-12 houses at Hilton. Housing surveyor, Council Offices.

Australia. — SYDNEY. — 27th September. County Council. 100 distribution transformers for city a.c. substations. (C.R.E. (I.B.) 68831/51. Ten/2859.)* 200 transformers for suburban substations. (C.R.E. (I.B.) 68852/51. Ten/2858.)*

Coventry.—Education Committee. Electrical installation in first of four hostel blocks at Training College. Applications by 7th September to W. L. Chinn, director of education, and tenders by 27th September to W. S. Hattrell & Partners, architects, 1, Queen's Road, Coventry.

Egypt.—CAIRO.—27th September. Director General, Cairo Electricity & Gas Administration. Supply of seventy 300 kVA and thirty 150 kVA transformers. (See 24th August issue.)

2nd October. Supply of 400 V switchgear. (See this issue.)

Haverfordwest.—3rd September. Town Council. Installation of electric light and power in 90 houses and other properties. (Deposit: £2.) Forms of tender from the borough surveyor, 9, Victoria Place.

India.—CALCUTTA.—7th September. Director of Cottage Industries. Switches, transformers and other electrical goods. (C.R.E. (I.B.) 68652/51. Ten/2848.)*

Merthyr Tydfil.—15th September. Corporation. Electrical installations in schools. (See this issue.)

Newcastle-on-Tyne.—City Council. Electrical installations in 580 houses on the Fairways, Montagu, and Slatyford Lane estates. City architect, 18, Cloth Market.

1st October. Education Committee. Electrical installation at Blakelaw Girls' Secondary School. (See this issue.)

South Africa.—JOHANNESBURG.—13th September. South African Railways. Supervisory control equipment for substations. (C.R.E. (I.B.) 68522/51. Ten/2842.)* Transformers, circuit breakers and switchboards. (C.R.E. (I.B.) 68521/51. Ten/2843.)*

BLOEMFONTEIN.—28th September. City Electricity Department. Supply of 25 MVA l.v. switchgear. (C.R.E. (I.B.) 68851/51. Ten/2855.)*

Stockton-on-Tees.—5th September. Corporation. Electrical installations in 84 houses and 68 flats on the Mount Pleasant estate (deposit £1 1s). G. Cowan, borough engineer.

Whitley Bay.—17th September. U.D.C. Installation of complete system of sodium vapour electric discharge street lighting in Earsdon Road. E. Roberts, surveyor, Council Offices.

Wrexham.—10th September. R.D.C. Wiring of 53 houses on the Plas Kynaston site, Cefn. D. E. Edwards, surveyor, Imperial Buildings, Regent Street.

ORDERS PLACED

Durham.—County Council. Electrical work at Hebburn-on-Tyne fire station (£351).—A. Robertson, Ltd., South Shields. Electrical work for additions to Seaham fire station (£757).—North of England Engineering & Electrical Co., Ltd.

Leeds.—City Council. Supply of switchgear and transformers required for the Knostrop sewage works (£16,083).—Yorkshire Electricity Board.

Middlesbrough. — Education Committee. Electrical installations in schools:—Lawson Secondary Modern School (£751).—Haigh & Ringrose, Ltd. Derwent Street School (£770).—C. Horne & Co., Ltd. St. John's School (£594).—A. Anderson & Sons.

South Shields.—Town Council. Electric battery vehicle for Cleansing Department (£441).—Crompton Parkinson, Ltd.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Bedlington.—Houses (32) for old people for the U.D.C.; direct labour.

Birmingham.—Two secondary modern schools, Church Lane, Handsworth; J. F. Gregg, town clerk, Council House.

Alterations at St. Peter's R.C. School, Broad Street for T.C.; F. S. Sharman, Kings Heath.

Birtley (Co. Durham).—Warehouse for Durham Chemicals, Ltd.; own architects.

Blackpool.—Houses for B.C.: 14 at Lorne Road, Knowle Estate East; R. Fielding & Son, Stanhope Road Works. 10 at Edgeway Road and

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Thames House North, Millbank, S.W.1 (Victoria 9040).

Myerscough Avenue, and 15 houses at Edgeway Road, Farringdon Avenue, and Nateby Avenue; A. Ashworth, 23, Longridge Avenue, South Shore. 33 houses and flats at Mereside; J. Halstead, Ltd., 19/21, Highfield Road, South Shore.

Boreham Wood.—Two schools, Theobalds Street (£103,860), for Herts C.C.; county architect, Hertford.

Brackley.—Houses (22) for T.C.; F. A. Hedges, Syresham, Brackley.

Bradford.—St. Anthony's R.C. School, Clayton; J. H. Langtry-Langton, architect, 8, Oak Mount, Manningham.

Bristol.—Primary school, Headley Park, for T.C.; city architect.

Chesterfield.—Houses (166), Calow Lane and Newbold Lane, for T.C.; borough surveyor.

Extensions to heavy tube department; Chesterfield Tube Co., Ltd., Derby Road.

Corby.—General hospital, maternity unit, diagnostic centre, etc., in connection with experimental hospital centre, for Oxford Regional Hospital Board; Offices of the Board, 43, Banbury Road, Oxford.

Coventry.—Dwellings (108) at Manor House estate for T.C.; T. Bates & Son, Ltd., 53, Warwick Street.

Crook.—Houses (174) on the Willington site; T. A. Page, Son & Hill, 75, King Street, South Shields.

Durham.—School at Penshaw for the C.C.; R. H. Duns, quantity surveyor, Lambton Road, Jesmond, Newcastle-on-Tyne.

College for further education at Durham City and technical college at Easington for the C.C.; Cairns & Byles, electrical consultants, 8, Osborne Road, Newcastle-on-Tyne.

Hostel at Winlaton for the C.C. (£27,568); Applebys (Builders), Ltd., Trafalgar Street, Newcastle-on-Tyne.

Enfield.—Departmental store, Hertford Road and Unity Road; Enfield Highway Co-operative Society, Ltd., 112, Ordnance Road.

Falmouth.—Classrooms, laboratories, etc., at Technical Institute; S. Gregson, architect, County Hall, Truro.

Felling (Co. Durham).—Houses (40) on the Ellen Wilkinson estate for the U.D.C.; Wimpey & Co., Ltd., builders, Jesmond, Newcastle-on-Tyne.

Hainault.—Shops (32), 31 maisonnettes and 14 flats, Manford Way; Stewart & Partners, Ltd., 105, Baker Street, London, W.1.

Hereford.—Workshops and offices, Holmer Road; Denco Engineering Services, Ltd., 3, Eign Street.

Horbury.—Additional works premises; Richard Sutcliffe, Ltd., Universal Works, Benton Hill.

Isle of Man.—Further extensions to Nobles I.O.M. Hospital and Dispensary; W. T. Quayle, 29, Athol Street, Douglas.

Keighley.—Alterations and additions to Holycroft Secondary Modern School for E.C.; H. V. Robinson, Ltd., Alice Street.

Leeds.—Houses (350) for T.C.; N. B. Bell & Co., Ltd., Frankland Terrace. 12 flats and 8 houses at Swinnow; J. Walker, Ltd., Wesley Road. 6 flats and 16 houses at Tinshill; W. Brown, Club Yard, Vinery Avenue.

Primary school, Low Farm, for E.C.; N. R. Paxton, architect, 11, Cavendish Place.

Liverpool.—New X-ray room and extension of existing X-ray department, Mill Road Hospital; architect to Regional Hospital Board, Premier Building, 88, Church Street.

London.—DEPTFORD.—Garage, Creek Road; Tarmac, Ltd., 50, Park Street, W.1.

ISLINGTON.—Flats (30) and six houses, Alwyn Square, for Metropolitan Police; Walter Lilly & Co., Ltd., builders, 8, St. Anne Street, S.W.1.

WALTHAMSTOW.—Houses (35), Blackhorse Lane, for Lee Catchment Board; J. Gerrard & Sons, Ltd., Victoria House, Southampton Row, W.C.1.

Manchester.—Workshops and offices, Trafford Park Road and Elevator Road; Key Engineering Co., Ltd., Trafford Park.

Middlesbrough.—Houses (82) at Berwick Hills for the T.C.; direct labour.

Middleton.—Extensions to offices for Soudan Mill Co., Ltd.; Sanger & Rothwell, architects, Yorkshire Street, Oldham.

Nottingham.—Extensions to Guildhall for T.C.; direct labour.

Notts.—Erection of Greenwood Drive Primary School for C.C.; Greenwoods, Ltd., 2, Wood Street, Mansfield.

Plymouth.—Extensions to factory, Honicknowle; Berker Sportcraft, Berkertex Works, Crownhill Road.

Portsmouth.—Flats (96), Leigh Park, for T.C.; city architect.

Rugby.—Secondary School, Overslade; John B. Surman & Partners, architects, 16, Harborne Road, Birmingham.

South Shields.—Marine and technical college for the E.C. (£500,000); Mead Taylor & Wilson, architects, Campden Hill, London.

Stratford-on-Avon.—Houses (41), Wellesbourne, for R.D.C.; Francis W. B. Yorke & H. M. Barker, architects, 36, Calthorpe Road, Birmingham, 15.

Strathleven.—Factory for Burroughs Adding Machine Co., Ltd.; Scottish Industrial Estates, Ltd., 3, Woodside Place, Glasgow.

Stretford.—Dwellings (122), Stretford Road, for T.C.; borough engineer.

Maternity Wing at Memorial Hospital; Thomas Duffy, architect, Sunlight House, Quay Street, Manchester.

Sturry (Kent).—Houses (68), Broad Oak site, for Bridge-Blean R.D.C.; building surveyor, Council Offices, Old Dover Road, Canterbury.

West Ham.—Dwellings (46), area bounded by Gainsborough Road, Manor Road, Corporation Street, Eve Road and Bethell Avenue; Thomas E. North, borough architect, 70, West Ham Lane.

Weybridge. — Dry freezing building at veterinary research station; E. Clarke & Son, Ltd., builders, Addlestone.

Weymouth.—Houses (80), Chapelhay Estate, for T.C.; Richards (Developments), Ltd., Manor Farm, Upwey.